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THE METAL INDUSTRY

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OLD SERIES Vol. 22. No. 2 — NEW YORK, FEBRUARY, 1916. — NEW SERIES Vol. 14. No. 2

THE MANUFACTURE OF SOFT SOLDER FROM SCRAP METALS

A Description of Modern Methods for the Handling of White Metals.

By Adolph Bregman

At present the white metal manufacturing business is in a very peculiar state. It seems that in all arts, at the beginning there is great secrecy, there is a deep mystery surrounding every process and the finished product is marketed with a sort of "Don't you think this is wonderful?" air. Later, as the knowledge spreads the number of participators in the deep, dark mysteries increase and it becomes harder and harder to 'slip anything over" on the buying public. Nevertheless everybody continues to maintain the same mysterious air as if he were in possession of something rare and fragile, something that could not bear full investigation. This is the condition of the white metal industry. Its secrets are known and shared by almost everybody, yet very few will give full, complete information about the manufacture of the various products.

Also, there is a lack of scientific research into the various phenomena peculiar to the white metals. The writer has searched through the entire literature of solders without discovering the chemical formulæ for the reactions which occur when a kettle full of metal is cleaned first with sulfur and then resin. In general, of course, it is easy to state that the oxides are reduced, but that is not detailed enough. What is the reaction with zinc? What is the chemical difference between the metallic looking scum on the surface caused by stirring with sulfur and the black dross which results from the final burning with resin? What is the reaction of the copper in the metal with sal-ammoniac? One can easily work out theoretical reactions, but it is well known that these are very untrustworthy.

Of course there is always the type of person who says, "What do we need this theoretical knowledge for? We know enough to manufacture the metals without them," but the argument is poor. One need only point to the German advances in applied science which are due entirely to research into the very minutest details. This has opened thousands of avenues for practical men to go into. Theory (as represented by research) appears useless simply because it is always far ahead of practice, but sooner or later every fact discovered by theory is found invaluable. The dye-manufacturing industries, and especially synthetic dyes are the best examples of this fact.

It is for these reasons that the writer wishes to publish a few facts about the manufacture of soft solder from scrap metal. There are no sensational disclosures to make; no "muck-raking," nothing but an attempt to set down the little practical details which are so useful to the person engaged in the manufacture of this product.

REQUIREMENTS OF A SOLDER.

Simply a strong tight joint between two or more sheets or pieces of metal.

MATERIALS USED.

As regards solders in general it is taken as an axiom that the solder must be made of the same materials as the substance to be soldered. Soft solder is made only of lead and tin (presumably). Hence the scrap must be of the sort to conform to these rules. The following materials are the most commonly used:

1. Tea lead.
2. Cable lead.
3. Tinfoil.
4. Pipe joints.
5. Pewter.
6. Britannia metal.
7. Very high grade babbitt.
8. Music plates.

It might be well to go into the composition and effects of the various materials.

Tea lead—About three per cent. tin; very good material.

Cable lead—From one to three per cent. tin; very good material.

Tinfoil—Generally pure tin but in some cases a few per cent. low; makes an excellent substitute for new tin.

Pipe joints—Vary widely in composition as the amount of lead pipe with the soldered joints varies. The solder is "lead solder" the composition of which is thirty-four per cent. tin and sixty-six per cent. lead. As a working basis, however, the composition of joints may be taken as fifteen per cent. tin and eighty-five per cent. lead.

Pewter—Varies with the grades. This material is widely used for making soft solder, but care must be exercised as antimony is present and also copper. The composition is as follows:

Tin	63-85%
Lead	15-37%
Antimony	Varying
Copper	1-2

Britannia metal—Varies widely depending upon the grade. As it contains antimony and copper, only very small amounts can be used with safety. The composition is as follows:

Tin	75-95%
Lead	—
Antimony	5-10%
Copper	1-3%

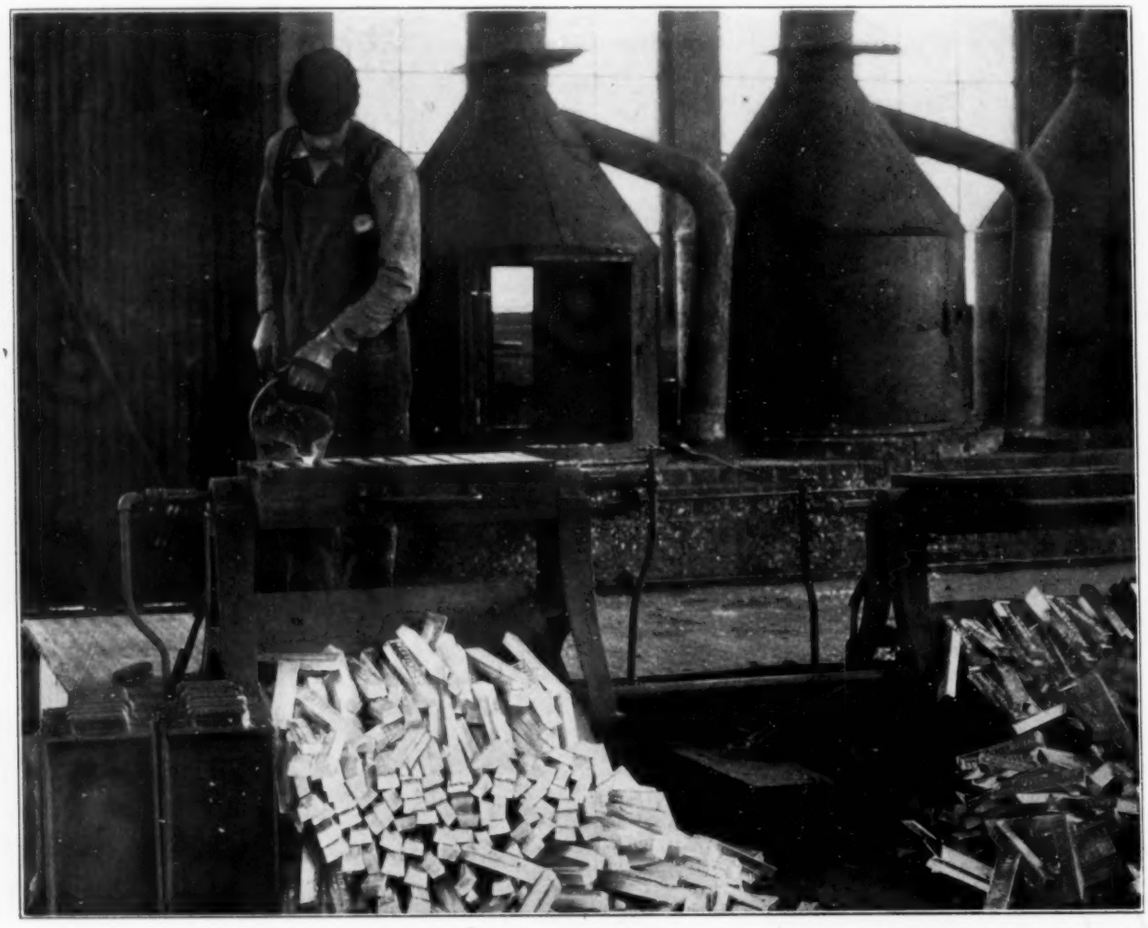
High grade babbitt—Varies so widely that it cannot be defined within any limits. It is very dangerous material to use as it is almost never without copper and large amounts of antimony.

Music plates—Very much the same as pewter in composition and effects, and must be used with the same care.

Besides the above named materials there are many kinds of scrap lead and tin, such as clean lead pipe, parts of yacht keels, tin pipe from breweries, etc., all of which are excellent things to use.

When the different materials from which the solder is to be made are placed in a kettle and melted down, the first things that make their appearance are the foreign substances which spoil the appearance of the solder. If they are present in large enough quantities some of them can be observed immediately in the kettle as a scum on the top of the bath, but if not, casting in the form of the regular solder bar will show them up plainly. The common impurities are as follows:

Zinc,
Aluminum,
Antimony,
Copper,
Oxides, dross, etc.



*A BATTERY OF THREE 3,000-POUND WHITE METAL MELTING FURNACES USED TO MAKE SOLDER AND BABBITS AT WESTINGHOUSE ELECTRICAL AND MANUFACTURING COMPANY, PITTSBURGH, PA.

DETECTION OF IMPURITIES

Zinc—The commonest impurity, but fortunately the easiest to discover and eliminate. It shows up as a scum which resembles somewhat the zig-zag lines of the galvanizing on sheet iron, and dulls the color greatly. In larger quantities it is thick and muddy.

Aluminum—Much rarer than zinc but very much harder to eliminate. Its effect on the appearance of the metal is much the same as that of zinc.

Antimony—In small amounts (two per cent. or less) this metal improves the appearance of the solder to such an extent that it is almost impossible to sell solder that is free from it. More than two per cent., however, results in spots, "pimples," and small discolorations on the surface of the bar, due to crystals rising to the surface. It also causes the sticks of solder to become very hard and brittle.

Copper—A common and very injurious impurity. It causes small raised surfaces like pin heads, and from a yellowish to an iridescent discoloration.

Oxides—Present in all metal baths of any kind. They can be noticed at the surface as a bright iridescent scum which is very thick and muddy, and refuses to flow as metal should.

All the above impurities are injurious in almost any amount. Other impurities exist, of course, such as bismuth, cadmium, arsenic, etc., but they are so rare as to be comparatively unimportant commercially. The following table shows the maximum amounts of these impurities which soft solder can contain without being injured perceptibly:

*This picture illustrated an article on Babbit, THE METAL INDUSTRY, May, 1912.

[1] Zinc	.005%
Aluminum	.03%
Antimony	2.000%
Copper	.15%
Arsenic	.03%
Bismuth	1.000%
Cadmium	.1%

REMOVAL OF IMPURITIES

The problem of the removal of these impurities is one which has been fairly well worked out in practice. The theory, however, the various individual reactions which occur in each case, is something which seems to be lacking. It may be that the writer has overlooked it. If so enlightenment on this subject would be welcome. As was stated previously, theoretical reactions are easy to construct, but they are very untrustworthy, and reactions based on careful analyses and research are missing.

The practical methods of eliminating the common impurities are as follows:

Oxides—Agitate the molten metal thoroughly with sal-ammoniac, resin or sulfur and resin. This agitation is effected best by means of a ladle which is dipped into the kettle and upon being raised is overturned, allowing the metal to drop back into the kettle.

Zinc—The metal must first be agitated or "thrown up," to use the correct shop term, with sulfur. Immediately a thick mud-like scum, but metallic in color, appears on the surface. This is the zinc. Continue, throwing on fresh sulfur if necessary, until no further zinc appears. Sometimes the zinc will assume a yellowish cast (due probably to copper). This also indicates that all of it has been brought to the surface. Then throw up the metal with resin instead of sulfur, throwing on fresh resin as the old burns off until the whole scum has changed from the original metallic color to brown and then to a deep black, and has become very fine and earthy in appearance. This material can then be easily skimmed and the metal in the kettle cast out.

As was stated previously the reactions of this process are uncertain, but it is known that all the sulfur is not burned off because the skimmings (the above mentioned black dross) were smelted in a reverberatory furnace and a certain amount of lead matte resulted.

Antimony—This metal cannot be eliminated even by re-sweating in a reverberatory furnace, as it forms an alloy with the tin when present in amounts up to ten per cent., and above that, forms a chemical compound SbSn, both of which have low melting points.[2] If it is found that the solder contains too much antimony, the only thing to do is to add pure lead and tin until the percentage is cut down to the right figure.

Aluminum—Can be removed just as zinc is, but it is very stubborn. It requires a number of thorough cleanings with sulfur and resin to eliminate it completely.

Copper—One of the most troublesome and injurious metals. There are several ways to get rid of it, but most of them leave the last fraction of a per cent. which causes the trouble. This can be eliminated only at the expense of a great deal of lost time. The methods are as follows:

(1) Force a small amount of sal-ammoniac (NH_4Cl) down to the bottom of the kettle, and "boil" the metal with it for a short time. This works very well if the copper is present in not too large amounts.

(2) "Boil" with some organic material like green hickory wood, a bone, a turnip, etc. This is quite effective but often takes a great deal of time.

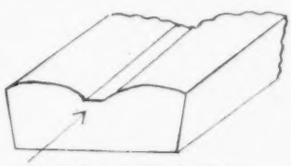
(3) Add a small quantity of zinc to the kettle and then clean thoroughly with sulfur and resin. The zinc carries the copper with it mechanically.

The first method is the one most commonly used.

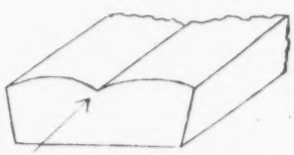
MECHANICAL MANIPULATION

If the solder has been made up largely of scrap, it may be assumed that most of the previously mentioned impurities will be encountered. Some, like zinc, can be eliminated without undue loss of time; others like aluminum or copper must be eliminated down to a very low percentage regardless of time. Antimony, on the other hand, can be retained up to the two per cent. mark. The trick is to keep it as high as possible without injuring the appearance of the metal. As is well known, the general, in fact almost universal method of judging solder is by its appearance. Solder is rated by its smoothness, brightness, freedom from spots, and the cleanness and lack of crystallization along the furrow up and down the middle of the bar. (The last is technically called "closing in.") At two per cent. antimony has a decidedly salutary effect in all these ways, in spite of the fact that it is really detrimental to the solder.

The fact is, however, that although antimony is not good for solder, it is probably not appreciably harmful in amounts less than two per cent. Also it gives such a bright, smooth appearance to the bar that no other impurity can escape detection. The phenomenon of "closing in" is a very peculiar one. The furrow running longitudinally on the face of the bar is an excellent means of detecting foreign materials.



a. THE FURROW NOT "CLOSED IN."



b. THE FURROW "CLOSED IN."

Solder which refuses to close in tightly as in Fig. a, may be made of pure lead and tin, but it may also have numerous impurities which show in the crystallization or roughness along the center. On the other hand, solder which does close in, as in Fig. b, without spotting, is certain to be quite free from other impurities than the two per cent. of antimony. Hence it follows that solder can be judged by sight quite accurately enough for practical purposes, and certainly much more quickly than by any other method.

The appearance of the bar, however, depends almost as much upon the skill and knowledge of the caster as upon the materials employed. It is impossible for the superintendent or foreman to watch every bar cast, and the caster must manipulate his metal so as to give him the best results. A few of the devices employed are as follows:

1. Casting on a drop—This is simply a small globule of metal in the end of each bar-groove and then casting each bar on top of this globule. Just why this "drop" has such an effect I have never been able to find out, but the results are often astonishing. There seems to be no definite time or condition for using the drop. The caster simply has to try it to find out. Very often it has no effect at all.

2. "Wiping" the metal—This consists of melting a small piece of clean solder of the correct grade in each dipperful taken out of the kettle to be cast. This is simply a slight dilution of the poorer metal with the better, and naturally cannot be worked if the poorer metal is more than slightly balky.

[1] From "The Surface Appearance of Solders," by C. O. Bannister, A.R.S.M., and H. J. Tabor. Journal of Institute of Metals, No. 2, 1909. Vol. 2, p. 58.

[2] "Alloys and Their Industrial Applications," by Edward F. Law.

3. Using "dope"—The dope consists of phosphor-tin, which has the effect of smoothing the face of the bar and making it run very freely, but also dulls the lustre. It must be used very sparingly and cautiously[3] or the whole kettleful will be spoiled. The reason for this is probably that phosphorus, being such a powerful deoxidizer cleans the metal of oxides to such an extent that it runs with utmost freedom as clean metal should.

Name	Per cent. lead	Per cent. tin & antimony
Warranted Half & Half.....	50	50
Strictly Half & Half.....	55	45
Half & Half	62	38
Refined	65	35
Wiping (in 5-pound ingots)....	62	38

A BAR OF "DUTCH BOY" NO. 111 SOLDER MADE BY THE NATIONAL LEAD COMPANY, NEW YORK. THIS SOLDER CORRESPONDS TO THE GRADE KNOWN IN THE TRADE AS "WARRANTED HALF AND HALF." IT IS GUARANTEED TO BE MADE FROM NEW LEAD AND NEW TIN AND CAREFULLY MIXED IN EQUAL PARTS (50 LEAD AND 50 TIN).

4. Regulating heat—A very important item, and one which can be prescribed only by the man working with the metal at the time. Sometimes it is best to keep the metal at as low a heat as it will run; at others a temperature just below that of rapid oxidation is necessary. In general a medium to strong heat which leaves a slightly colored film of oxide on the casting end of the bar is best for most conditions.

The "Regular bar" weighs about twenty-four ounces. The "Boston bar" is longer, narrower and thinner, and weighs about sixteen ounces. The "Capping bar" is about the same length as the regular bar, but semi-circular in cross-section and a little thicker than a pencil. Other types such as bars of triangular cross-section, extra-heavy or extra-light bars are made specially to suit the needs of the purchaser.

A BAR OF "DUTCH BOY" NO. 244 SOLDER MADE BY THE NATIONAL LEAD COMPANY, NEW YORK. THIS SOLDER CORRESPONDS TO THE GRADE KNOWN IN THE TRADE AS "STRICTLY HALF AND HALF."

Among other "stunts" which the caster uses to facilitate his work are the following:

1. "Smoking the mold" by burning resin or wood under an upturned mold. The grooves and little cracks become lined with carbon and the sticks of solder are picked out much more easily.

2. When cleaning metal with sulfur and resin the metal should be just hot enough to light the sulfur to a gentle blue flame. If it is much hotter, it burns too quickly (in

A CAKE OF INGOT SOLDER MADE BY THE NATIONAL LEAD COMPANY (N. Y.)

a white blaze) and has no effect on the metal. Often, if the metal is not too far above the right temperature, covering with fine coal ashes and then using fine crushed sulfur instead of lumps or sticks, works very well.

3. When copper is present, most of it will come out with the zinc in cleaning and can be observed by the yellowish to iridescent color on the scum formed during the burning with sulfur. The burning with resin must be continued until the dross which results is very fine and deep black.

TYPES AND GRADES OF SOLDERS

The general trade names and grades of the various solders on the market are as follows:

[3]Twenty-eight parts phosphor-tin to forty-five thousand parts solder according to the article "Solders, Their Characteristics and Uses," in Machinery, Oct., 1911, p. 86.

ANNEALING OF BRONZE.

A study has just been completed by the Bureau of Standards, Department of Commerce, of the annealing of bronze, using the commercially important alloy, zinc-bronze (copper 88, tin 10, zinc 2) as a type and the results published in Technologic Paper No. 60, just issued.

The properties of cast steel may be greatly improved by refining the grain by proper annealing. The changes occurring in cast brasses and bronzes upon annealing are by many metal workers regarded in the same light. The results of the Bureau's study show that bronze is very different in its behavior from steel and shows no recrystallization or "grain refining" unless it has been previously cold worked as by rolling or hammering.

Copies of the publication, entitled "Microstructural Changes Accompanying the Annealing of Cast Bronze," may be obtained without charge from the Bureau of Standards, Washington, D. C.

COPPER FLUCTUATIONS IN JAPAN.

The year 1913 was considered one of great depression for the copper trade in Japan. In 1914 prices declined from $330 per ton, early in January (on the basis of prices prevailing in the London market), to the low level of $275 per ton, which was reached about July 15. This decrease in price was gradual until the end of June, when the uncertainty of political conditions abroad caused an abrupt decline from $300 per ton to the low level in July. On the outbreak of hostilities, exports, until the end of October, fell to almost nothing, but later they increased considerably, reaching in December the unprecedented figure of 7,386 tons, valued, however, at only $2,076,284. The exports in November were 4,764 tons, valued at $1,290,884. Most of the December exports were shipped at about $290 per ton.

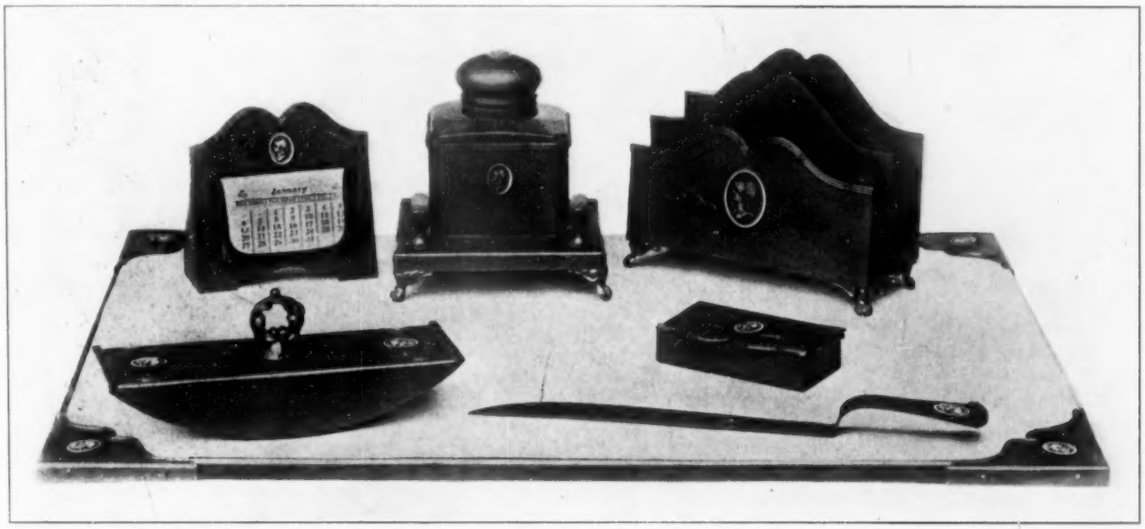
THE INFLUENCE OF STYLE ON THE ART METAL WORK OF MODERN TIMES

THE LAST OF A SERIES OF ARTICLES ON THIS INTERESTING SUBJECT. EIGHTH PAPER.

BY A. F. SAUNDERS.*

(Concluded from August, 1915.)

In the seven preceding articles on this subject appearing from time to time in THE METAL INDUSTRY I have endeavored to give the art metal craftsman some idea of the principal characteristics of definite decorative period styles as developed from prehistoric times through the classic periods, the Middle Ages, the Renaissance, up to and including the new art movement of the present day. Obviously the designer of art metal wares must be familiar with the evolution and development of the various styles of ornament and, too, the metal craftsman should be well grounded in this interesting subject that he may more fully understand and appreciate how much the wares that he produces are influenced in their conception by the various periods of style.



A BRASS DESK SET, ON WHICH THE IDEA OF CLASSIC DECORATION HAS BEEN CARRIED OUT.

We owe much to the artist craftsmen of past centuries for our artistic inheritance and instinct, and while perhaps striving to break away from old traditions in an endeavor to create a new and glorious epoch of decorative style based upon the tastes and requirements of the present age and people, we nevertheless can not help but be influenced in our modern creations by the art styles of the past.

No style or period of ornament has developed from nothing in the past, a new style has been the outgrowth of some change in the mood of a nation, as instanced in the complete difference of feeling between the different periods of the French Renaissance. Take that of Louis XIV, a style dignified and gorgeous, representing the feeling of the French nation when it knew its greatness and its accumulating wealth. Following this the style of Louis XV, typifying a complete change in conditions, a development of the frivolous and shallowness not at all evident in the preceding epoch. Following this the Regency which so ably represents the voluptuous, dissolute characteristics which are so clearly connected with the period. So we may study all the various decorative styles and will find that each style represents and reflects the life and temperament of the people at that time, and, like the art of a people so be it with the designer or craftsman. He shows forth himself in his art and his craft, his work is what he is, for he puts himself into every line and every stroke, reflecting in his creations what his surroundings and education and experience have made him.

The designer in contemplating, we will say, a silver vase, classic in form, what inspires his ideals but his knowledge and thorough appreciation of the chaste beauty of the Greek period? What influences his ideals but his careful studies of the art of the classic periods? The finished design may not be Grecian at all, but a chaste form ornamented perhaps with some simple floral motif, the whole thoroughly in accord with the spirit of the modern Renaissance, yet his inspiration has been received and stimulated by his appreciation and understanding of the ideals of an art-loving age. Thus we draw inspiration from our predecessors without copying them. We should be ourselves seeking expression of our individuality. During the whole course of history metal work has held a foremost place among the arts, and no other craft can boast of a greater artistic triumph than has been won by the metal craftsman in the gradual development of his art.

The art of working in the metals has a somewhat different story than is found in the other arts of handicraft, suffering like vicissitudes of fortune, still it shows a continuity of development or at least a never entirely forgotten skill, which, with the possible exception of the engraving of precious stones, is lacking in the allied arts.

For centuries back metal has held its place by reason of its durability and its ever-increasing possibilities. In proportion to their malleability and ductility the various metals have dictated their own artistic de-

*Designer, Benedict Manufacturing Company, East Syracuse, N. Y.

velopment. Unlike wood and stone it can never be utterly destroyed; it can be re-fused and re-fashioned into new wares of manifold use and beauty.

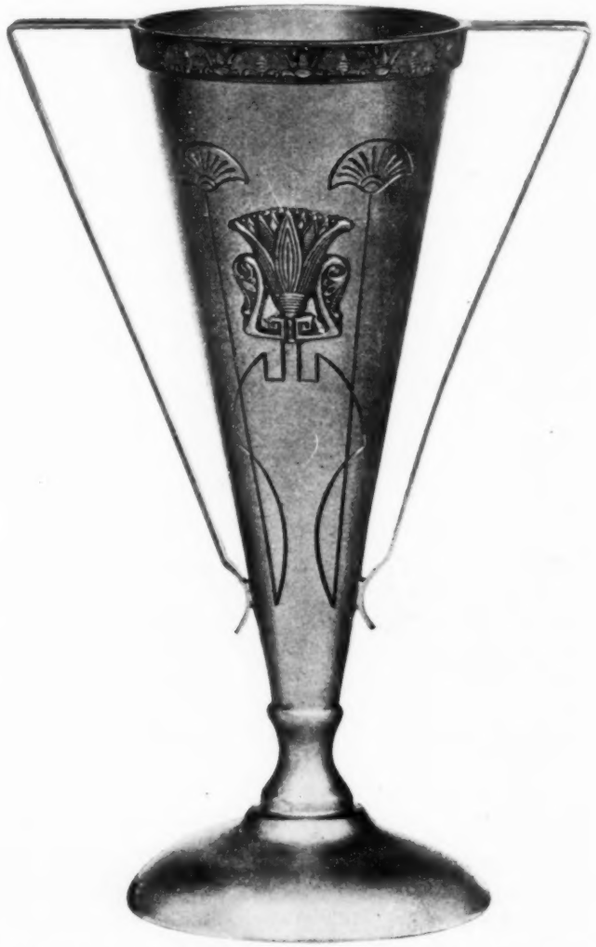
We are sometimes told that originality is no longer possible or desirable, that our best things have already

A CLASSIC FORM WITH SIMPLE FLORAL MOTIF FOR DECORATION.

been done for us, but do we not sometimes mistake the true meaning of originality? It may result from a determination to be unique, eccentric, different; but we may be quite original without departing from the paths of order, simplicity and frankness, receiving inspiration from the past, yet be individual and original in our conceptions, skilled and thorough in our craftsmanship. The result will be beautiful in direct ratio to our appreciation and understanding of the principles underlying line, form, decoration, composition, and our control of the tools and materials with which we are working.

The several illustrations accompanying this article will perhaps give some idea of how these principles may be applied to modern art metal ware.

A PITCHER UPON LINES OF THE GREEK PERIOD.



A VASE WITH DECORATIONS BORROWED FROM EGYPTIAN DESIGNS.

ALUMINUM IN NORWAY.

Commerce Report states that according to the Dutch Legation in Stockholm, an extensive aluminum smelter is being organized at Höyanfjord, Norway, where there is a waterfall which may furnish 60,000 horsepower. It is proposed to develop 20,000 horsepower at once, to provide for the production of 4,000 tons of aluminum per year. The capital stock of the company is fixed at $3,350,000, of which $2,680,000 is subscribed. The banks of Christiania and Bergen have declared a willingness to underwrite a loan of $1,000,000 for the company. A number of bauxite beds have been secured in southern France, where the ore will be worked into oxides and shipped in this concentrated form to Norway for the final conversion into metal by electrical furnaces.

NICKEL ANODES AND DOLLARS

SOME PRACTICAL OBSERVATIONS AS TO THE PROPER PROPORTIONS OF ANODE SURFACE IN A PLATING BATH.

BY FRANKLIN W. HOBBS.*

The object of this article is to call attention to the error of limiting the anode surface and also to suggest methods whereby practically the whole anode may be consumed in the plating tank.

Tons of partially used anodes go to the scrap heap at a sacrifice of more than half their original cost per pound. Most of them, had they been given a fair chance, would have enriched the solution in which they hung, and made dollars for the owners. Therefore, as dollars are what we are all seeking, the subject seems entitled to some serious consideration.

Flat anodes are, or should be, a thing of the past. At the present time they have no reasonable excuse for existence, unless it be to fill the orders of those who haven't learned better. They offer unnecessary interference with the circulation of the solution, while they yield slower than either the oval or round style, because of the lesser number of edges.

The oval I consider the best form, and they should be supplied in numbers sufficient to form a liberal excess of anode surface over work surface.

Some platers, or their employers, are constantly deceiving themselves with the idea that they are saving money as long as they succeed in plating without adding new anodes. The sooner the idea is abandoned of considering anodes, first as a conductor, and lastly as a source of metal, the sooner more dollars will be realized from the business.

It is false economy to limit the anode surface in order to reduce first cost, because if we are to turn out good, uniform work, the metal content of the solution must be kept uniform, and a large anode surface will very nearly accomplish this. Whereas, if the anode surface is limited, one must be constantly adding nickel salts.

About seven pounds of nickel ammonium sulphate must be added to supply one pound of nickel, while anodes would yield upwards of ninety-five per cent. nickel.

Reference to the cost of salts and anodes, very promptly settles the argument in favor of anodes, while the cost of labor required to dissolve salts is still another argument in favor of the anodes.

It must also be seen that if the anode surface is sufficiently large to very nearly or quite keep the solution supplied with the requisite amount of metal, there will be no sudden changes in the solution as when salts are added.

Given favorable treatment, fully ninety-five per cent. of the anodes should be consumed in the bath, leaving five per cent. or less to go to the scrap heap.

It is no uncommon thing to see two or three inches of the anodes projecting above the solution. By a little attention to this detail, one may very soon discover how much water to add to each tank at the close of the day's run to offset waste due to drip from work, evaporation, etc., thus, keeping the surface of solution as near as possible to the top of the anodes. A look at a pile of old discarded anodes shows us many pieces which were broken near midway of their length after having been reduced in size at that point so that they could no longer sustain the weight, the lower ends were then discarded because there was no suitable way of hanging them in. This was due to improper loading of the tanks, and its correction I deem most important.

Take for illustration a tank supplied with 24 inch anodes. Pieces of work perhaps ten of twelve inches long are to be plated. They are hung in a single row with their upper surfaces an inch or two below the surface of the solution. Now as the anodes yield most at the points nearest the work, little or no metal is drawn from the lower half of the anodes, and if the same practice is followed, they will weaken at, or near the center, and after a time the lower half will part company with the upper half and become a candidate for the scrap heap. To save this waste, suitable hooks or racks should be provided so that two rows of such work could be hung, one below the other, thereby making the demand upon the anodes practically uniform their entire length. Even then long anodes sometimes become so weak that they cannot sustain their weight until exhausted. It is advisable to anticipate such a condition and slip small burlap bags over each anode, tying them over the top. The burlap will in no way interfere with the proper action between anodes solution and work. It is a mistake to allow anodes to become nearly exhausted before adding new ones for two reasons: First, because of the reduced area exposed and the consequent depleting of solution, and second, because of the slow-yielding qualities of the new ones when first hung in. New ones should be hung between the old, and the old ones allowed to remain as long as they will reach the solution.

If the plater is reluctant to allow the scrap man to have even the little that is left above the solution, he may unsolder the copper hooks and extend the hole through each piece, string them on small iron rods which are threaded at the lower ends, screw a nut up tight on each, and hang them in again. But little of the iron will be exposed, and what is will do no harm. Thus, there will be but little beyond bolts and tank sweepings for the scrap heap.

A few years ago there appeared upon the market the so-called "basket anode" which, in theory, solved the problem of nickel anode waste. In practice, I found it practically worthless. The device consists of a carbon plate with metal hooks to engage the anode rod, a piece of burlap to be laced about the carbon plate, supporting pieces of old anodes. The high resistance of the carbon, and the corrosion taking place between hook and carbon still further increasing the resistance, combine to make the device of very little use.

The question of cleaning or not cleaning anodes is one upon which platers differ widely, some advocating not cleaning at all, while others go to the extreme of scraping and scratch brushing. I prefer washing in clear, warm water by brushing slightly with a soft brush and rinsing. Scraping and scratch brushing seems to me to be the rankest kind of abuse and waste, both in material and labor. Nickel anodes in liberal numbers, so manipulated as to be practically all consumed in the solution, thereby reducing the consumption of salts to a minimum, and avoiding the junk man, means the largest number of dollars in return for nickel anodes.

*Foreman Plater, Bangor, Me.

HARDWARE GREENS ON BRASS.

Nitrate of iron gives better results in producing hardware greens upon cast brass or sheet metal goods than acetate of lead. The usual method is pursued of dissolving the nitrate of iron in hyposulphide of soda —one ounce of the iron in four to eight ounces of the soda in each gallon of water. Use hot.—November, 1915, Review American Electro-platers' Society.

MAKING BRONZE KEYED BUSHINGS IN CAST IRON CHILLS

AN INTERESTING FOUNDRY PROBLEM AND HOW IT WAS SOLVED.

BY JOSEPH MC GINNIS

The bushings as shown in Fig. 5 are made with a key on them and on account of the cost and difficulty of machining it was decided to cast them in chills so that no machining would be necessary. When they were given to me to make, I thought I was surely up against it, as they had been tried out before and given up. I knew that black, red and white lead had been used on the chills and the only materials I could think of to use that might prove efficacious were water glass and tin. I tried the water glass with poor

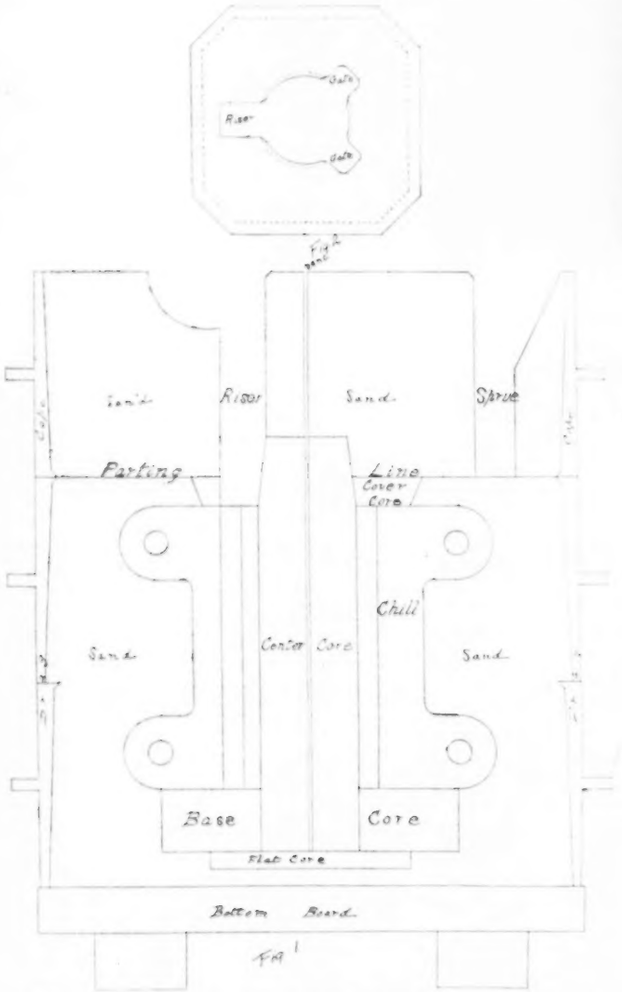
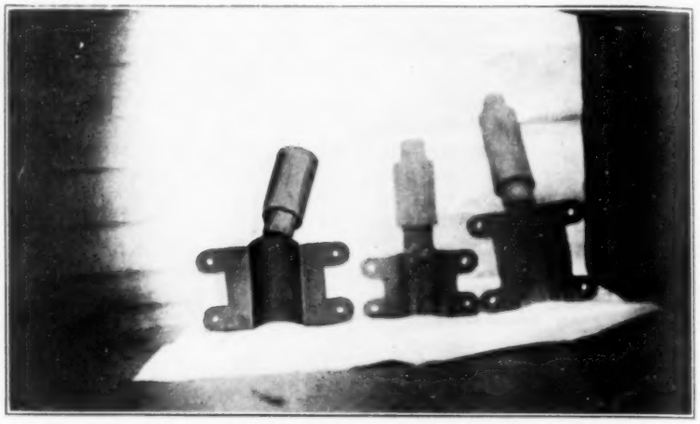


FIG. 1. SECTION OF MOLD FOR CASTING THE BUSHING.
FIG. 2. ABOVE, PLAN OF THE COVER CORE.

results, but the tinning did the trick; the castings being good and sound.

Fig. 1 shows a section of a mold; Fig. 2 is a plan of the cover core; Fig. 5 is a cross section of the bushing, which is 6¼ inches long, 3 inches outside diameter and 2⅛ inches inside; Fig. 3 is a section of form used in chill when making the mold, the ends being prints for center core, and Fig. 4 is a plan of the base core.

The chills are made of cast iron and split, as shown, in the center of the key. After tinning they are bolted together. The mold is made as follows: The base core is put on the mold board and a small flat core is put over the hole in it. A nowel is then placed on the board, sand shoveled in, rammed and struck-off, the bottom board is put on and the nowel rolled over.



A PART OF THREE CHILLS AND PATTERNS, NOTE FLANGE ON TOP OF THE PATTERN ON THE LEFT.

The bottom print of the form, as shown in Fig. 3, is inserted in the hole in the base core and the chill, which should be very hot, slipped over it and set on

FIG. 3. SECTION OF FORM USED IN CHILL WHEN MAKING THE MOLD.

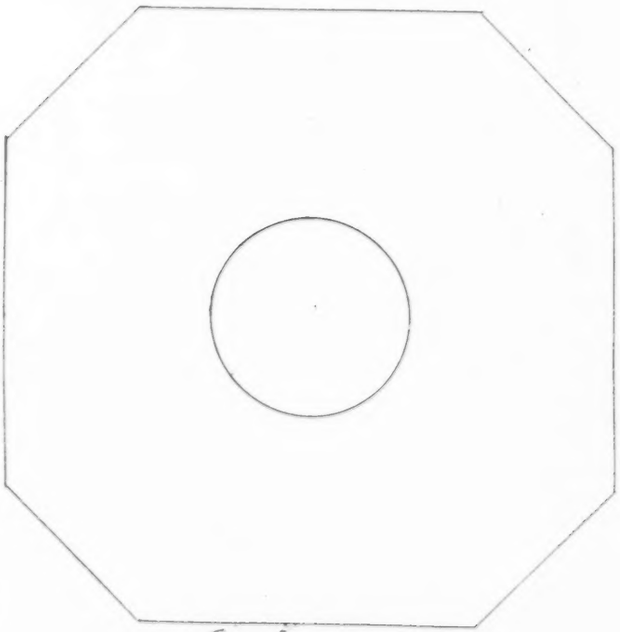


FIG. 4. PLAN OF THE BASE CORE.

the base core. After tinning and bolting the chills I keep them in the core oven. Then waste is put in the key-way of the chill to keep sand out and the cover core is placed in position. Another nowel is put on the first, and the top of it should be flush with the top of cover core. Sand is now put in, rammed and the parting made. In making the parting, sand is put in holes in the cover core and is pressed so as to show in the cope, where the riser and gates are. The cope is rammed, lifted off, turned over, the gates cut and holes punched for vent, riser and sprue. The cover core is then lifted up, waste removed and the form taken out, after which the center core is placed in position and the cover core replaced. The cope is now turned over, riser and sprue rimmed out and placed on nowel. I pour the castings fast with hot metal as soon as closed, although I do not flow any metal through but just fill the riser. I am not sure how often chills can be used without re-tinning, but I have used them twice and the castings have turned out all right.

[We should be pleased to hear from other molders as to how they solve their problems.—Ed.]

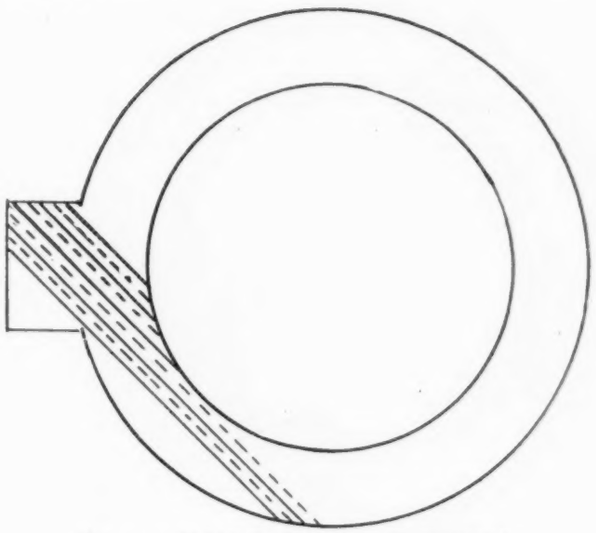


FIG. 5. A CROSS SECTION OF THE BUSHING.

WHEN DOES IT PAY TO INSTALL BRASS FOUNDRIES?

AN ACCOUNT OF AN INVESTIGATION WHICH ANSWERED THE QUESTION IN THE NEGATIVE.

BY W. L. CHURCHILL.*

Until foundries as a whole have a more intimate knowledge of their costs, the average manufacturer should hesitate long before adding a brass foundry to the list of his departments unless for other reasons than those of economy. When it comes to a question of getting castings made cheaper than one can produce them, it is a notorious fact that if one has the time and disposition to job around, he can get castings made at figures that he could not hope to compete with in his own shop. This condition is in large measure due to the numerous small shops started by molders who have more ambition than business experience and who quote prices without a due knowledge of their cost of production.

The business mortality of this class of shops is such that the unscrupulous buyer of castings who hunts for the lowest prices is apt to find his patterns being shifted from one closed shop after another, and as he is largely responsible for their closing, he is entitled to little, if any, sympathy for his trouble on this score. Larger and well established foundries are not altogether blameless as they are frequently led to meet competitive prices of these smaller and less experienced plants, and often do this without full investigation as to whether they can profitably do so or not; in fact, many of them prefer not to find out. Some manufacturers, tired of the constant change of suppliers of their castings, and unwilling to patronize the more substantial concerns with their higher prices, are induced to install small foundries of their own in the belief that they can obtain castings cheaper this way. This is not always a profitable venture and many manufacturers date a shrinkage in profits from the introduction of their own foundries, although not all of these are able to discover the cause of this shrinkage, so sure are they that their brass foundry is saving them money.

An extreme case of this character came recently under the observation of the writer, of a manufacturing firm that had operated for several years on a profitable basis, then suddenly discovered they had lost considerable money in their annual operations. Not until the third successive annual deficit did the bondholders become sufficiently alarmed to insist on the investigation that disclosed the true cause of the trouble. The firm used a large quantity of a standard type of bronze fittings that called for very rigid tests, and specifications demanded all new metal in the mixture.

Believing they could manufacture at a lower price than they were paying, a foundry was introduced, but on account of the thin character of castings, and the small amount of metal per charge, the total weight melted was six times the weight of the product. Between oxidation losses multiplied by 6, enormous fuel and crucible cost per unit of production and the loss by sale of their re-melt at scrap prices, this firm was so badly handicapped that they could not hope to compete with large foundries melting more economically and with opportunities to utilize the gates, sprues and other re-melts on other lines. Despite a high state of labor and equipment efficiency in their foundry operation, they were headed for complete ruin so long as they continued activities of this department. The prompt closing down of this branch of their business brought immediate change from a losing to a profitable business.

The underlying reason for the prolonged operation under the unprofitable conditions was lack of definite and detailed knowledge of the exact costs of their brass foundry operations. Although a complete and well-operated accounting system was in use, it failed to segregate the facts pertaining to this branch of their business. This is a very common condition, as seemingly the foundry conceals mysteries that the average accountant is unable to discover or handle and many items of foundry cost are permitted to lodge in some general expense account that if properly segregated and applied against the specific product to which they belong might discourage many a manufacturer from continuing a hopelessly expensive department or line of product and become more reconciled to the just charges of the substantial jobbing plants that operate on a basis of exact knowledge of their costs.

*Efficiency Engineer, New York, N. Y.

ENGLISH SPECIFICATIONS FOR ALLOYS FOR HIGH-SPEED SUPER-HEATED STEAM TURBINE BLADING*

REVIEW OF NON-FERROUS MATERIALS FORMERLY USED: AND OF SOME WORTH FURTHER CONSIDERATION FOR TURBINE BLADING PURPOSES.

BY W. B. PARKER, F.I.C. (Rugby.)

(1) Brass.—Probably the first non-ferrous alloy used for turbine blading was brass. All the chief types have been used, viz., 70:30, 60:40, and 52:48, which represents the α, ($\alpha + \beta$) and β constituents of the copper zinc series. Such alloys are readily extruded or drawn and rolled; consequently their price is comparatively low, which naturally caused their early adoption. However, these brass alloys have been found unsatisfactory for blading the high-pressure end of rotors or wheels of modern superheated steam turbines. They anneal during use rather rapidly, and become too ductile and weak to maintain the working stresses—this means they stretch or bend until the revolving parts touch the stationary parts, and then the friction and continual impacts produced break them up. It has sometimes been considered that cases of blades stripping were caused by warping of the blades due to differential expansion of the body of the steel rotor or wheel relatively to the brass blades; but this is a less probable explanation than that the metal is actually softened by steam-heating while under stress. The latter has been definitely proved. The author is not cognizant of any published investigation of an instance of stripping which can be said to have definitely proved that thermal expansion alone was the cause of the stripping.

If breakdowns are not immediately and thoroughly investigated, it is easy for such an explanation to be invented, because, on the one hand, there is probably the brass blade manufacturer protesting that the alloy was made from the best ingot metals, melted and worked up in just the same way as before, by just the same persons, and they are sure it must have been perfectly uniform, and like all the rest of the blading they ever sold; and, on the other, the steel-maker presents his laboratory certificates of analysis and tensile tests, and challenges the engineer to produce tests which can cause the steel to be blamed; while the engineer claims that his design took into due consideration all such common phenomena as thermal expansion. It is self-evident that scientific investigation and actual tests alone can correctly explain these troubles, and lead to their prevention. Therefore each case should be forthwith scientifically investigated, and every means, chemical, physical, microscopic, mechanical, etc., should be employed, and parties interested should co-operate as far as their respective facilities and knowledge permit. The object is of sufficient importance to warrant disclosing manufacturing processes, etc., for in some cases it may mean life or death to the operators of these machines—for instance, in warships.

Now, suppose alloys of 60 : 40 or 70 : 30 brass are annealed until dead soft, but not burnt, what kind of material would result?

Investigations show that the resulting physical properties would be something of this order:

Maximum stress, 20 to 23 tons per square inch.
Proportionality limit, 2 to 4 tons per square inch.
Elongation, 70 to 50 per cent.
Modulus of elasticity, 14,000,000 to 18,000,000 pounds per square inch.

This, then, is the material which will ultimately result from use of brasses in modern superheated steam turbines, and when one knows that the working stresses in the rotor or wheel blading may be anywhere between two and seven tons per square inch, it is quite clear that it is not suitable for these blades, although in some cases it may answer for the stationary blades.

(2) Copper.—In the early days, the only non-ferrous rival to brass was pure copper.

This metal is, however, quite unsuitable for modern blading, and is not recommended for nozzle plates or stationary blades, because it is altogether too soft, weak, and changes very considerably under prolonged heat.

This was to be expected, for it has long been known that at 300 deg. to 400 deg. C. copper is completely annealed in a few hours, and it has no proportionality limit in the dead soft condition, and that its maximum stress is only about 12 tons per square inch.

(3) Zinc, tin, lead, and aluminum are likewise useless.

(4) Nickel.—Pure nickel free from carbon is difficult to obtain in sound ingots, and also somewhat difficult to produce in rolled or other worked shapes.

However, there is a possibility that it would answer for stationary and unstressed blading and other parts, if only the manufacturers would produce it purer and try to work it into bucket shapes, which is the only form in which it is likely to interest probable users, and induce them to thoroughly investigate its value.

In small wires and rods (under 0.375 inch (⅜ inch) diameter) ordinary commercial nickel gave the author the following tests:

Maximum stress, 40 to 55 tons per square inch.
Proportionality limit, 6 to 10 tons per square inch.
Elongation on 8 inches, 4.5 to 2 per cent.

It is evident these results represent hard-drawn metal, and the material contained some carbon, iron, manganese, etc.

Although Mond nickel (in shots) can be as pure as 99.95 per cent., no one appears to have succeeded in producing wrought nickel of this purity. The author has not had much opportunity for examination of wrought nickel, as no pure nickel blading has been submitted by nickel manufacturers for investigation.

Possibly in the pure and dead soft condition wrought nickel would only possess:

Maximum stress, 18 to 20 tons per square inch.
Proportionality limit, 6 to 10 tons per square nch.
Elongation, 8 to 15 per cent.

These values are a deduction, based upon an investigation of very pure cast nickel made some years ago by the author.

According to Schulz pure nickel cannot be employed—the exact purity is not given. His experiment consisted in annealing in an oven (? gas fired) a bar of nickel, coated with clay, and packed in a sheet metal jacket with iron turnings (? carbon content). The annealing lasted four weeks at a temperature from 650 deg. to 700 deg. C. The tensile strength fell from 47 tons to 27.95 tons per square inch, the elongation rose from 4 per cent. to 24 per cent., and he remarks that the material had become completely brittle.

*Read before the Institute of Metals, England, at a recent meeting.

This fall in strength is not astonishing, because the original high test is clear proof that the metal was in a very much cold-worked condition. With respect to the brittleness, it is highly probable that, in spite of the coat of clay, some of the carbon from the scrap iron used for packing and also from the furnace gases had penetrated the nickel, and had become cemented and alloyed. Nickel readily absorbs carbon mon-oxide (CO) and other gases which render it brittle (and in the cast condition unsound). Nickel can also become saturated with graphitic carbon, which is absolutely fatal to its strength.

Schulz quotes no analysis and gives no microstructures, and it is not clear whether he was writing entirely from the points of view of using the metal in gas turbines or steam turbines.

According to Weidig, annealing for one hour at 400 deg., 600 deg., and 800 deg. C., and cooling in air, reduces the strength as follows:

Item.	Orig. Metal.	After Anneal'g for 1 Hour at 400° C.	600° C.	800° C.
Tensile tons per sq. in....	48.0	47.9	40.1	34.5
Elongation, per cent.....	3.5	11.0	11.5	32.5

From this, it looks as though in the dead soft condition nickel would have the strength produced by the 800 deg. C. anneal, but since no analysis is quoted by Schulz, we again must be cautious.

Another authority—Robin, Paris—reports that the maximum brittleness occurs at 300 deg. to 350 deg. C. It is clear the question needs further research, using specially prepared materials.

Professor Gowland quotes a tensile test of 42.4 tons per square inch for wrought nickel (reported by Shakell), but neither its purity nor the size of "stock" tested is given.

Schnabel and Louis quote Kollman's result as:

Maximum stress, 38.9 tons per square inch.
Elastic limit, 24.6 tons per square inch.
Elongation, 15 to 21 per cent.

But they omit to state whether this is for cast, forged, rolled, or drawn metal—it is also uncertain how the reported elastic limit was determined.

Kollman's result was obtained upon nickel which had been deoxidized with magnesium by Dr. Fleitmann's method, which is still commonly used.

In a recent report by H. T. Kalmus and C. Harper, written for the Canadian Department of Mines, and entitled "Physical Properties of the Metal Cobalt," the strength of pure cast nickel is given as only 8 tons per square inch.

(5) Cobalt.—This metal has only recently gained the attention of metallurgists. Consequently, with the exception of the results obtained by Kalmus and Harper, practically nothing is known about its fitness for engineering purposes. The rough averages of Kalmus and Harper's tensile results for pure cobalt are:

A. CAST AND UNANNEALED.

Maximum stress, 14.7 tons per square inch.
Yield point, 12.4 tons per square inch.
Elongation, under 1 per cent.

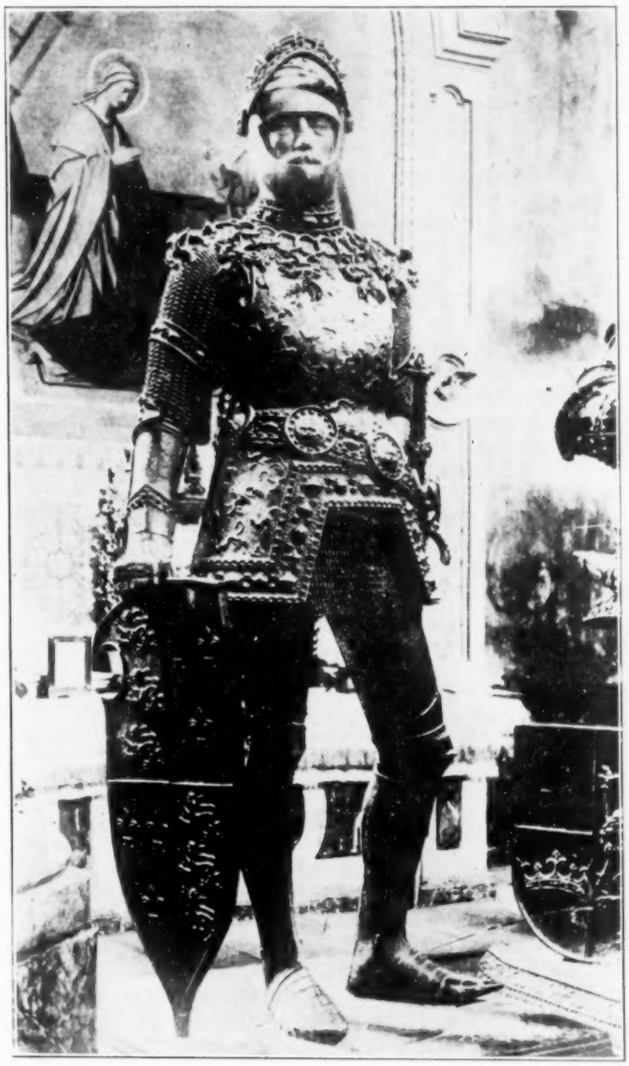
B. CAST ANNEALED.

Maximum stress, 16.5 tons per square inch.
Yield point, 14.1 tons per square inch.
Elongation, under 1 per cent.

C. WIRE (WROUGHT).

Maximum stress, 39.8 tons per square inch.
Yield point, not given.
Elongation, 3 per cent.

BRONZE STATUES FOR GUNS



THE GREAT HEROIC BRONZE STATUE OF THE LEGENDARY KING ARTHUR OF ENGLAND AT INNSBRUCK, WHICH THE AUSTRIANS WILL MELT AND MOLD INTO GUNS TO BE USED AGAINST THE ALLIES. THIS IS ONE OF THE 28 SIMILAR STATUES THAT ADORN THE CAPUCHIN CHURCH, THE OTHERS BEING OF THE EMPEROR MAXIMILIAN AND HIS LEGENDARY ANCESTORS.

Photo Copyright by American Press Association.

The above investigation was not intended to reproduce industrial conditions, and therefore the results may easily be bettered in some modern works. There should be an industrial outlet for cobalt, and very great credit is due to the way in which the Canadian Department of Mines has tackled the subject. This metal should certainly receive attention from blading manufacturers.

(6) Copper-Nickel.—It is well known that these alloys have been utilized by several turbine manufacturers, but they are alloys which frequently suffer from the presence of graphite (free carbon), which has a tendency to segregate in the center of the ingots, and therefore it is found finally as a "core" in the most dangerous portion of the blading, *i. e.*, just where the neck of the blading is formed.

The most commonly known example of a copper-nickel alloy is that given the name Monel metal. The following

tests on three sizes of wrought bars of Monel metal may be interesting:

TENSION TESTS.

No.	Size, Inches Diameter.	Proportionality Limit, Tons per Sq. In.	Set of 0.001 In. on 2 Ins., Tons per Sq. In.	Maximum Stress, Tons per Sq. In.	Elongation per Cent. on 3 Ins.	Elongation per Cent. on 2 Ins.	Reduction of Area per Cent.
21	½	18.0	18.2	41.2	40.0	45.6	69.5
22	¾	18.0	17.8	39.9	41.0	47.0	71.0
23	1	27.25	29.1	42.3	33.4	40.0	66.0

In all three cases the fractures were sound, and had a silky to granular appearance. The samples were said to have been rolled to size.

Specimens of Monel metal turbo-blading gave:

Maximum stress, 38.70 to 39 tons per square inch.

Proportionality limit, 16 to 14 tons per square inch.

Elongation on 4 inches, 32 to 33 per cent.

Reduction of area, 66.75 to 70.7 per cent.

Modulus (between 1 and 15 tons per square inch stress), 22,500,000 pounds per square inch.

This is the strength of the wrought metal in the unannealed condition.

ANALYSIS.

	Per cent.
Silicon	0.14
Lead	trace
Copper	27.0
Iron	3.85
Manganese	1.87
Nickel	67.10
Carbon	nil

Monel metal usually contains silicon, and is liable to contain both graphitic and combined carbon, totalling up to 0.5 per cent. These depreciate its value for rotor and wheel blading, but still it may be used for stationary blades under certain conditions.

The items—total carbon, graphitic and combined carbon, and silicon—certainly need controlling.

Monel metal is reported to be the product of smelting a mixed copper-nickel ore, and upon this basis has been claimed to be a natural alloy. This is, however, a questionable use of the term natural.

A similar and equally good copper-nickel can be made direct by alloying pure Mond nickel with electrolytic copper, and adding similar percentages of iron, manganese, and other elements to produce the physical properties, and magnesium to keep it sound. Deoxidation with phosphorus should be avoided.

If free from carbon, silicon, phosphorus, and sulphur, these copper-nickel alloys are useful for some types of blading, but the turbine manufacturers really search for a material which is of all-round utility.

(7) Copper-Manganese.—Is an alloy now used by some builders of the reaction type of turbine. The author has not yet fully investigated this material from the turbo-blading side. Judgments based upon the results of its use for firebox stays are not safe, for the stresses, etc., are so different. The alloys are not strong, and it is not definitely proved that they retain a sufficiently good proportionality limit after prolonged exposure to steam at 230 deg. to 300 deg. C. for the more highly stressed rotating blades. The composition of the alloys used varies between 4 per cent. to 6 per cent. and 15 per cent. manganese, and Schulz gives the strength at 350 deg. C., as 22.50 tons per square inch and 40 per cent. elongation.

(8) Copper-Aluminum (so-called aluminum bronze).—For practical purposes these alloys are summed up in two alloys—the 7 per cent. aluminum and the 9 to 10 per cent. aluminum. Neither of these have come into continued use for turbine blading, and it is unlikely they will because they anneal too readily, and the proportionality limit in the dead soft condition is too low. It is unfortunate that for some years after their discovery the aluminum bronzes suffered from being over-praised—their ductility and fairly respectable maximum stress have often misled users who did not take the necessary precaution to get a more complete test.

The following results were obtained by the author for the 9 to 10 per cent. alloy forged and tested in the soft condition:

No. 6124/6127.

Maximum stress, 31 to 32 tons per square inch.

Proportionality limit, 6 to 8 tons per square inch.

Elongation, 21 to 24 per cent.

Reduction of area, 23 to 28.5 per cent.

The material tested was very nearly pure.

(9) Copper-Aluminum-Manganese Alloys.—These alloys are of comparatively recent discovery, and were first reported upon by Dr. Rosenhain and Mr. Lantsberry in 1910. The copper-rich portion of the series is worth further investigation, for the results given in the paper are an incentive to detailed work.

(10) Copper-Aluminum-Nickel Alloys.—This series contains alloys which possess very remarkable physical characteristics at ordinary temperatures, and the presence of other elements in percentages of 0.5 per cent. to 5.0 per cent. has most interesting effects upon the forged alloys when in a more or less work-hardened condition.

The copper-rich portion of the series appears to have been discovered by continental metallurgists some years ago. Their materials were not pure copper-aluminum-nickel alloys—the only published results for the pure alloys are those contained in two recent papers by Professor A. A. Read and R. H. Greaves, read before the Institute in 1914.

For purposes other than turbo-blading the more impure alloys have already come into considerable use.

The results published by Guillet in 1906 and 1914 refer to the more complex commercial alloys. The results of tests upon such metals are very much complicated by the presence of other elements, although these seldom exceed 5 per cent.

These alloys present many difficulties in control of production, and a novice will find trouble right from the melting stage. So far the writer believes that they have not been worked up into blading.

The following results are representatives of the forged metal of everyday practice, and are intended to encourage manufacturers to try to obtain similar but "natural" results in turbine sections:

TYPICAL COMMERCIAL ALLOYS.
ANALYSIS PER CENT.

Mark.	Silicon.	Copper.	Iron.	Aluminum.	Nickel.	Manganese.	Zinc.	Magnesium.	Tin.	Lead.
K	0.04	82.07	trace	2.54	14.64	nil	0.68	nil	nil	nil
R	0.14	79.63	4.80	9.77	4.13	0.94	nil	trace	nil	nil
H	...	79.0	4.5	11.5	5.0	nil	nil	trace	nil	nil

The author believes these alloys foreshadow rivals to the special alloy steels now utilized for the most highly heated and stressed portions of the rotating blading.

The alloy steels are being used from sheer necessity for

something which possesses naturally a good proportionality limit which is not too seriously annealed or "let down" by prolonged exposure to the highest temperatures already named.

None of these steels are perfectly satisfactory, because one trouble common to them is their natural tendency to rust. The so-called non-rusting 25 per cent. to 30 per cent. nickel steel has been definitely abandoned for reasons which may shortly be published in a paper before another Society. While the complex ternary and quaternary copper alloys are being investigated, turbine manufacturers have largely relied upon various steels, but there is one very old-fashioned copper alloy which has proved useful, and in some instances decidedly preferable to the steels, because it is non-rusting. This alloy is:

(11) Phosphor Bronze.—For this purpose only the pure copper-tin-phosphorus alloy is of value. The presence of zinc, lead, aluminum, etc., is detrimental. The composition and general physical character of this alloy is indicated by the following specification:

ANALYSIS.

Tin, not under 3 per cent., not over 5 per cent.
Copper, not over 96.9 per cent., not under 94.9 per cent.
Phosphorus, not under 0.1 per cent.

The metal containing from 3.5 to 4.0 per cent. tin is preferred, because it is required to have as much natural hardness and stiffness as is compatible with the physical properties given below. The alloy is of course a pure *a* type, and the phosphorus is all in solid solution in the *a* constituent.

PHYSICAL PROPERTIES.

Maximum stress, not under 24 tons per square inch.
Proportionality limit, not under 12 tons per square inch.
Elongation on 6 inches, not under 10 per cent.
Elongation on 2 inches, not under 13 per cent.

N.B.—Any higher elongation than 20 per cent. on 6 inches would be superfluous for the purpose.

The modulus of elasticity of this material in the condition as received from the makers varies from 16,000,000 to 17,800,000 pounds per square inch within the range of stress 0 to 10 tons per inch.

The manufacturers need, however, to pay much more practical attention to the production of a definite and uniform size of grain—that is, the rolling, drawing, and other process-treatments need careful standardization on such a basis that all sizes (thicknesses) of sections when finished are possessed of the same physical condition as each other. The working of metals is a huge subject in itself, but most manufacturers know that unless real thought and care is taken in planning treatments, there is a natural tendency for the small sections to be overworked, and large ones to be only surface worked. The troubles arising from this fact were well described by Professor Heyn in the 1914 May lecture, but one very curious effect of surface working came under the author's notice recently.

The metal was an almost chemically pure bar of copper, intended for switchboard work, for which purpose it was skimmed to size all over and screwed at the ends—a high-speed lathe with a light cut and high rate of traverse being employed. The energy in the outer skin of the bar caused the metal to spring up in front of the point of the tool and from what the workman termed "whiskers." Now, in turbine blading all such internal stress or unstable energy is a decided defect.

Consequently the aim should be to produce a material free from such, and free from greatly exalted proportionality limits or maximum stress. A naturally high proportionality limit and maximum stress is in urgent demand, but all artificially enhanced properties are more or less unstable, and they do not benefit the user when he employs the material under conditions which release unstable energy, and lower these properties during the normal lifetime of the apparatus constructed with the material.

In addition to the probability of the occurrence of warping, there is also the possibility of the presence of microscopically small cracks, which will spread, owing to the localizing effect they have upon stresses of all kinds, and especially upon those more or less rapidly produced by release of the internal stresses correlated with artificial proportionality limits, etc.

Manufacturers must constantly remember that a single unsatisfactory blade suffices to cause serious damage in a turbine. The responsibility which, in the public as well as the commercial sense, rests upon turbine blading manufacturers is great.

The following results will suffice to show that no permanent progress appears possible amongst the brass type of alloys, and the author sincerely hopes that these results will turn the attention of British manufacturers off this worn-out track on to others which better warrant immediate original investigation. The problems will not be solved by the invention of fancy names and quotations of high prices.

BRASS ALLOYS.

To combat the argument that brass is sufficiently good for blading the lower-pressure end of turbines, it may be stated that it is a case of erosion from wet steam—water erosion—a defect to which brass is liable, because it is too soft *per se*.

Many modifications of the three typical brasses 70 : 30, 60 : 40, and 52 : 48 have been proposed and tried, and these include practically all the so-called manganese bronzes and brasses. No definite advantages have been found in their use, and in the long run they behave like ordinary brass.

(To be continued.)

"ADAM" GRAY FINISH ON BRASS.

The term "Adam" as applied to a finish is merely a fictitious term as a name might be given to any finish, and yet that finish might be the same as produced by a dozen other concerns.

The gray is probably a Flemish finish, and such grays are produced in various ways. For a dip solution consisting of 1 gallon of water, 8 ounces of muriatic acid and ½ ounce of arsenic will answer the purpose. The solution should be used at a temperature of 160 to 180 degrees. It is advisable to dissolve the arsenic in the acid first by the aid of heat and before adding to the water.

In the place of the arsenic butter of antimony may be used in the same proportion or a little more. Butter of antimony is a chloride of antimony.

The browns are produced by various solutions containing sulphur or sulphur compounds and probably one of the best is to prepare a solution as follows:

Water	1 gallon
Caustic potash	8 ounces
Yellow sulphide of antimony..	1 to 2 ounces

The solution must be used at a temperature of 160 degrees and the proportions may be varied and yet good results be obtained. After the brass articles are immersed in the above dip they should be washed in cold or hot water then immersed in a warm dip consisting of 1 gallon of water, 1 ounce of sulphate of copper and 1 ounce of acetate of copper. This dip is termed the toning dip and produces a darker tone to the brown.

Articles to be finished in solid browns after the brown is produced should be scratch brushed dry, using soft or worn brass wire brushes.—C. H. P.

BRINGING A JEWELRY FACTORY UP TO DATE

THIS SERIES EMBODIES ADVICE ACTUALLY GIVEN TO THE MANAGER OF A POORLY EQUIPPED AND OUT OF DATE JEWELRY FACTORY. A PREVIOUS INSTALLMENT DISCUSSED IMPROVEMENTS IN FLOORS, WALLS, LIGHTING AND VENTILATION.

BY C. M. HOKE, B.S., A.M.*

(Continued from January.)

The air is bad in your shop not only because the men are working in a small, practically windowless room, but for other reasons as well. For one thing, the dust collecting system is far from successful, as is witnessed by the deep red color of the walls and ceiling around it, and the dark Indian complexion of your workers after a short period of work. Another reason is the soft porous floor, which collects dust and then gives it up again when walked on; but this you expect to get rid of soon. A third reason for bad air is that your hoods and canopies do not draw.

You have the following hoods: a small acid hood, for carrying off the fumes generated in refining or "cutting down" metals; a big canopy over the gold melting furnaces; a cyanide canopy, extending over the electroplating equipment; and smaller hoods for annealing, and so on. All are used for other purposes beside their main one. But in many cases they do not accomplish any purpose at all—a workman goes to a hood to melt shellac, for example, but he might as well melt it at his bench, because the fumes go all through the room. The same may be said of the acid hood—except when the wind is just right. And it is a fact that the odor of cyanide may be detected clear out into the hall of your building. The objection to this condition is not merely that it makes your air "bad"; bad air is bad enough, since it deadens your men's efforts, but cyanide and acid fumes make them definitely sick. In addition to which (we regret that this is the reason that appeals most strongly to some minds) acid fumes attack the machinery, and discolor finished work.

Therefore, look to your flues. Your building is tall, so that the main chimney draws well, and it is your own fault if you do not get a good draft. Tear out the long, narrow, much twisted pipe that connects your canopy with the chimney (carefully collect the dust within it), and put in a larger pipe with as few bends and crooks as possible. One or two of your small hoods can easily be moved up so that they connect almost directly with the chimney. Add dampers, so that the pipes out of use may be closed off. The heat produced by the furnace when in operation is sufficient to carry a draft up the flue if you give it a chance.

But there is not enough heat under the acid hood or the cyanide canopy to produce a draft. Hold a lighted match under the edge of the hood or canopy, and you will see that the flame is not drawn in. Something more is needed to develop a draft. Both hoods are too far from the big chimney for it to have any great effect on them. The only thing to do with the cyanide hood is to put in a blower. It can be so arranged that the blower will improve the draft on the other hoods also. You will find that it will not be necessary to run this at all times, such as in very cold weather, or when little coloring is being done.

The acid hood needs complete overhauling, as it is thoroughly inadequate—does not draw, is dirty, and is so inconvenient that the refiner would rather work without it than with it. At your very first opportunity, get one of the fire-proof glass hoods, with wooden frame and a window that slips up and down, and a drained floor. These are provided by the chemical supply houses, and are really acid hoods, meant for use with acids—not small editions of the gold furnace canopy. They have these great advantages: they never need repairing and painting; it is possible to see what is going on inside them all the time, without opening the window, and without special illumination; the walls never scale off and drop into the solutions, and they are easily cleaned.

In the meanwhile you wish to fix up this old sheet metal hood so that it will be of some use, at slight expense. Remedy the draft by connecting it with the chimney by a larger pipe, free from leaks, and straight—there is no need for bends and elbows. Place an ordinary gas jet in the throat of the hood—where it narrows into the pipe. When lit, this will improve the draft, and provide a certain amount of light. Paint everything heavily with black asphaltum paint, inside and out, remembering that when acid reaches the metal it makes it scale off and drop into the solutions. You use this hood for cutting down fine gold, refining, etc., and the solutions are frequently of considerable value, so that you do not want dirt dropping into them. Therefore the importance of frequent paintings, and the advisability of replacing the metal hood with an all-glass hood.

Take out the old, corroded, wabbly gas burners now in place. Cover the rough brick floor of the hood with a smooth, firm base, preferably slate or soapstone; tilt the floor very slightly toward one corner, where a hole is bored, and beneath which a big crock is stationed. Then if a vessel breaks or boils over there will be a minimum of loss and damage. Because of this danger of breaking and boiling over, it is best to use movable burners, attached by flexible tubings, instead of the gas burners permanently piped in; then when an accident happens it is easy to clean the floor of the hood. Do not let burnt match ends, bits of charred paper, sand, etc., accumulate in the hood, for you will regret it when an accident happens and you find it necessary to refine this trash for the precious metal it is mixed with.

When arranging the gas pipes, remember that you will want to reach the gas cocks at times when the hood is full of fumes, and whenever an accident occurs. Therefore place the cocks a good distance from the burners, for the sake of your hands. Above all, do not place the gas cocks in the back part of the hood, where it is necessary to expose your hand and arm to fumes in order to reach them, and where they will promptly corrode. The best place for gas cocks is outside the hood, underneath the front edge of the floor; there they are easily reached, and are not in danger of being brushed against unwittingly.

Since the little gas jet provides only a flickering light, it is well to arrange an electric light bulb so that just the glass part extends into the hood, through its roof; leave the metal part and the key outside. Buy two or three of the round metal-bound asbestos pads sold in department stores for ten cents each, and use them under the vessels of solution, instead of the half-inch asbestos board you now use. The thin asbestos gives full protection against the direct heat; the thick board does no

*Consulting chemist, Jewelers' Technical Advice Co., N. Y.

better, and needlessly slows down the process of heating.

You have complained that the blower connected with your melting furnaces is not satisfactory. Most of your troubles are due to dirt and neglect. First, clean the blower well in all its parts, and repeat the process often. Like any other piece of machinery, it requires cleaning and oiling. The air intake is badly placed, being near the floor in a dusty part of the room. Remember that large quantities of air go through the blower, and that whatever dirt this air carries goes into the machine. By extending the intake tube some four feet you can place the intake out the window, where it can catch only good clean air. This will make fewer cleanings do the work, and will cost almost nothing.

It is necessary to oil a blower more copiously than most people realize, inasmuch as much oil is carried away by the current of air. Put in an oil cup, with sight feed, and then watch it. It is not enough to put in the oil cup—the oil cup must be kept filled and feeding freely. This sounds like trite advice, but it is a fact that many blowers are condemned because of neglect of this simple precaution. Sometimes a blower develops the trick of blowing out the gas. This happens when the belt is loose; the belt then alternately catches and slips, and the result is a series of puffs in the air current. This is a very annoying trouble, whose solution is simplicity itself—tighten the belt.

(To be continued.)

(In a subsequent article the wash barrels, dust collecting devices, and other parts of the factory will be discussed.)

SPEEDING UP THE ELECTRO-DEPOSIT

THE EVOLUTION OF THE SINGLE NICKEL SALTS IN STILL AND MECHANICAL PLATING SOLUTIONS.

BY CHARLES H. PROCTOR.

Slowly but surely the progressive electro-plater has at last commenced to realize that the metal in his solutions is an important factor and that unless a solution contains plenty of metal he cannot carry the amperage that tells the story of the rapidity of the deposit. The required voltage to push the amperes along is important, but if the volume of metal deposited in a given time was dependent upon the voltage we should be using volts instead of amperes, yet many volts and no amperes means no deposit.

Special nickel salts that are still being sold depend not only upon a better conducting material in solution, but upon much more metal in their compound. It is the metal that costs and that is what you pay for, because it means a deposit in one-third less time than with the ordinary double nickel salts solution, so the story is told in metal. It is only a matter of a few years ago since the plater realized that he could use single nickel salts in his solution. He first commenced to use one ounce, then two ounces per gallon of solution and the results were deposits of a whiter color and the finish was more uniform. There was also less work returned from the polishing department due to cutting through the nickel. Yet some platers were afraid to go much further, although some went ahead and today are using single nickel salts exclusively at a saving of 50 per cent. in the cost of maintaining solutions.

The advent of the special nickel salts brought about the evolution of the single nickel salts in solutions and the plater commenced to reason out why such combinations gave quicker results and were more soluble in solution. At first he purchased some salts at thirty cents per pound or more, then after a while he thought again and finally he woke up from his slumbers and realized that the more efficient results were due to the higher metal content in solution.

The single nickel salts contain from 21 to 22 per cent. metal, or approximately 50 per cent. more than double nickel salts which contain 14 per cent. metal. As commercial ammonium salts are cheap they can always be added as a separate factor, but very little conducting salts are actually required as long as plenty of metal is in solution. In the manufacture of special nickel salts one important fact was considered and that was that ammonium salts could be used very sparingly, better not at all; because it was realized that not more than 12 ounces of double nickel salts could be used successfully per gallon of water. Twelve ounces of double nickel salts contain about 1.68 ounces of metal and in the winter time, due to lower temperatures, 8 to 10 ounces can only be used per gallon, owing to the danger of recrystallization lowering the metal content from 1.40 to 1.12 ounces per gallon of solution. The lower content of metal means less amperage and a much slower deposit with the same voltage and also dark and burned deposits.

The special nickel salts solution frequently contains as high as 4.50 ounces of metal per gallon, three times as much amperage as on a solution low in metal means a deposit of one-third the time. I have visited metal plants in the different manufacturing sections of the United States where all classes of metal goods are produced and was greatly impressed with the evolution of the single nickel salts, which has been brought about, no doubt, by continued discussion of the merits of more metal in solution.

As an example of what can be produced by the single nickel salts solution, a number of mechanical solutions were recently installed in a city in the Middle West and the proportions used were as follows:

Water	1	gallon.
Single nickel salts	1¼	pounds.
Boracic acid	2	ounces.
Magnesium sulphate (Epsom salts)	1	ounce.

As soon as the solution was prepared and cooled to the proper temperature it was set in operation. The material was of steel and some of the parts had quite deep recesses which would prove whether the solution was sufficiently conductive to deposit in such recesses. In fifteen to twenty minutes the parts were sufficiently plated with a clear bright and white uniform deposit of nickel upon every piece. This test proved conclusively the value of the single nickel salt solutions.

The tanks were of 200 gallons capacity and were loaded to the top. The same work plated with the ordinary double nickel salt solutions using a high voltage to hasten the deposit resulted in deposits that were considerably darker and which stained rapidly in a few days. This was no doubt due to the excess of ammonia developed in solution, which causes considerable trouble in barrel plating. The solution prepared according to the formula above mentioned contained 4.40 ounces of metal per gallon. Still solutions may be prepared by using two-thirds of the proportions given above.

THE PRODUCTION OF ETCHED METAL GOODS

A Description of the Enamel Process Told in a Practical Way.

By William Voss.

Some years ago the writer described a process for manufacturing etched metal goods, such as name-plates, clock dials, scales, etc., in The Metal Industry* known as the transfer process and since the publication of that article I have received numerous requests for details regarding that and other methods of etching, one of which I will endeavor to describe in this article. The process I am about to describe is known as the "Enamel Process," the principles of which have been known and used for many years in the photo-engraving business in the production of zinc and copper engravings and which, with a few changes in the various formulas, have been utilized for the production of the well-known name-plate. The principles of this method consist in coating the face of brass or copper plates with an acid-resisting solution which is sensitive to light, exposing the sensitive surface under a glass negative to daylight, similar to the method used in printing out paper used in photography; washing or developing, drying, burning in the enamel, retouching and coating the back, etching, plating, removing the enamel, blackening or oxidizing, drying, lacquering, cutting up and punching holes.

By this process sharp letters and fine lines are produced, but the etching is usually shallow, that is, one cannot etch as deep with this process as in the process described in my former article. Since the enamel process requires printing from a negative, it will be seen that an abundance of good daylight is very essential. It means that the location of such a plant should have the use, if possible, of the roof of the building and it should be so constructed that rain, snow or cold weather will not interfere with the printing.

MAKING THE BRASS PLATE NEGATIVE.

The first operation of the process requires a design or drawing of the finished product. This is usually drawn several times larger than the finished product, due to the fact that it allows the draughtsman more range, so that any ragged edges in his drawing will not be noticeable in the finished article after being reduced to size. The complete drawing is then sent to the photograph department, where a negative is made of the drawing. In some cases the negative is reduced to the exact size, in other cases only partial reductions are made and the working negative is reduced to size. From this first negative a number of prints are made on a good paper, and the best results are obtained in black and white tones, as strong contrast is what is desired. These prints are now mounted upon a board or cardboard, mounting as many on as possible, according to the size of the working negative.

Let us assume that the finished name-plate measures three by four inches and the paper prints have been made to size, that is three by four inches. We will now be governed by the number of three by four-inch reproductions we can get upon our working negative, or, in other words, if our working negative measures 13 by 14 inches we can reproduce 12 copies of our three by four-inch prints. The size of the brass plate must also be considered. That is, we lay out our stock of brass, with as small amount of scrap or waste as possible, and print as many of the finished product as possible at each exposure. Where a large number of the finished product have to be made it will be of considerable advantage to make a number of these working negatives, which are made by the so-called wet-plate process. If it takes 10 or 12 minutes for the exposure of one large plate containing 12 name-plates then 10 or 12 plates may be exposed at the same time and that means taking advantage of the time of the day when the best light is obtainable.

Assuming we have our working negatives all ready, they are then examined for pin-holes and retouched. The negatives are now ready for the next operation, and before taking it up it might be well to say a few words in regard to the kind of brass to be used, for it is upon the proper selection of this metal that much depends on the success or failure of the name-plate business. The metal must be of a good uniform yellow brass, for if it shows streaks of red (copper) or spotted it had better be discarded, as such spots or streaks will not become black, but will assume a reddish or brown appearance, while other parts may oxidize to a good black, thereby making the product useless.

The next operation is to cut up the brass, which should be cut slightly larger than the pattern on the working negative in order to leave a small margin or border after printing. The brass plates are now ready for polishing or buffing, depending upon the finish desired. The method of polishing varies from the usual method as the polishing machine should consist of two rollers, one a large drum about 24 inches in diameter and the other about eight inches in diameter. Emery is sprinkled upon the brass plates, which in some cases are polished the full length of the sheet before being being cut up, or just the opposite, as the case may be. The rollers revolving slowly away from the operator grip the plate between them, thereby giving the surface a polished or grain effect, the grain depending upon the grade of emery used.

The brass plates, being cut to size and polished, are rinsed in clean water and if the water breaks on the polished surface a few rubs with a little moist emery on a brush will readily leave the plate free from oil or grease. The plates are then set into a rack to drain; as the racks become filled up they are removed to the sensitizing room, where they are coated with a sensitizing acid-resisting solution. The clean, polished brass plate is now held in the hand with the clear face up and the sensitizing solution is poured near one corner and the plate is tipped so that the liquid spreads all over the surface, after which it is drained off into a bottle used for this purpose, allowing the liquid to drain from one of the corners. The brass plate is laid upon an iron table, face upwards. This table is so constructed that a few turns from a crank handle causes the table to revolve, thereby throwing off the surplus sensitizing solution from the brass plate, and, in order to prevent the liquid from being thrown about, the revolving table is constructed with metal sides. A small gas stove is also kept burning under the table so as to facilitate rapid drying. Two coatings of the sensitizing solution are usually given, after which the plate is again whirled on the revolving table and is then placed into a rack and left to dry.

This entire operation of coating the brass plate requires to be done in a ruby or red light and the room so constructed that daylight cannot enter, the light ob-

*The Metal Industry, December, 1905.

tained usually coming from a window that has the red or ruby glass set into the frame.

When the brass plates are dry they are ready for printing. Now take the working negative with the 12 copies on it and place face up in a printing frame. The brass plate is placed sensitive face downwards, care being taken that the brass fully covers the copies. The back of the frame is clamped into place. This operation also requires to be done in the "red room." After the frame has been securely clamped it is exposed to daylight, the time of exposure depending upon the various factors, such as the strength of light, the kind of a negative and the sensitizing solution. By the latter it is meant the strength of the sensitive salts and the age of the solution. The correct timing of the exposure is gathered by experience; ten minutes on a bright day means a considerable longer exposure on a dark, dull day; also the time of the day and the time of the year are important factors. Therefore it is best to do the printing during certain hours upon a roof, as previously mentioned. The rest of the time can be devoted to making negatives.

The brass plate, having been timed properly, is removed from the printing frame; a hole or slot is punched in the scrap edge to allow hanging the plate form a hook into a tank of water to which a small amount of methyl violet has been added. The object of the methyl violet is to make the design easier to distinguish. The parts that have been acted upon by the daylight remain insoluble, while the parts unaffected by the light dissolve out, the methyl violet showing the design boldly in all its detail, and the plate is gone over with a soft camels'-hair brush to remove any particle that may cling to the plate, after which it is set aside to dry.

After the plate is dry it is "burnt in," that is, it is held over a blue gas flame, face up, until the enamel turns brown (not black), when it is again set aside to cool. Retouching is the next operation which the plate has to undergo, the design being gone over for pinholes and defects and these are retouched with asphaltum or lacquer. The back is also coated to prevent the acid attacking it, and the plate again is set aside to dry.

ETCHING THE BRASS PLATE.

Now the brass plate is ready for the etching solution and the plate is allowed to remain in this solution until sufficiently etched deep enough. As has been stated before, the etching is usually shallow, the reason for this being that the enamel does not offer the same resistance to the acid as some of the asphaltum or resinous compounds, although for deeper etching the work may be rinsed and transferred, after the acid has taken, to a chloride of iron solution, and after sufficient depth has been obtained it is again rinsed and returned to the first etching solution. In all etching solutions the work must be kept agitated and the method of doing this varies with the different manufacturers. In some cases large trays about 12 inches deep by eight feet square are used. These trays are so constructed that they are pivoted in the center, the tray resting upon a cradle that is connected with a wooden strip to an eccentric pulley, the motion being about four to six inches. This allows the etching solution to flow over the plates in one direction for a short time, then the tray is given a quarter of a turn and allows the etching fluid to flow crosswise. The reason for this is that if the acid were allowed to flow in one direction throughout the entire etching process the plates would become streaky, thereby ruining them. This method also has its disadvantages, as well as its good points.

Another method of etching consists of using a deep tank similar to a plating tank, a track is then fastened to the top edge of each long side and upon this track a frame rides. This frame is connected to an eccentric shaft, which moves the frame back and forth. Glass rods are set into the frame and upon these rods the plates to be etched are suspended from hard rubber hooks. Hard rubber strips are also suspended from the frame into the solution and these help to agitate the etching solution. This method requires a large quantity of etching solution.

The etching tanks should be protected from the action of the etching solution. One method is to use lead-lined tanks and another method is to coat the inside with a heavy layer of pitch. If the latter method is used, considerable care must be exercised each time the etching solution is prepared, as the solution becomes quite hot and would cause the pitch to run. Whichever method is used, the etching, if properly done, will come from the etching bath with a clean, sparkling, matted background. Unless this surface is produced the richness of the silver white will not be produced. The plates, as they come from the etching solution, are thoroughly rinsed and transferred to the silver solution, letting them remain in this solution for a few minutes only, or until evenly silver-plated and free from stain. No blue dip, mercury, or striking solutions are used as in the regular method of silver plating brass.

FINISHING THE PLATES.

After silver plating, the plates are dipped into a hot potash solution. This removes both the enamel and the backing of asphaltum or lacquer, whichever has been used. The plates are now lightly brushed over with a soft, wet bristle brush and bicarbonate of soda, rinsed thoroughly and immediately placed into the black or oxidizing solution, and in this solution the brass is blackened, providing, as previously mentioned, the brass is of the proper quality. The plates remain in this oxidizing solution several minutes or until thoroughly black. It sometimes happens when the oxidizing solution becomes old that the brass does not become black, but assumes a tarnished, smoky effect; but this may be overcome by removing the plates from the solution, rinsing, brushing over with bicarbonate of soda, rinsing, and again returning them to the black solution. By far the best remedy when this condition is noticed is to prepare a new oxidizing solution, as the color turns out much better and a great deal of time is saved, regardless of the amount of worry it does away with.

The brass plates, after having been oxidized or blackened and if properly done, will present a sparkling silver ground with bright black letters. The plates are now thoroughly rinsed and dried in warm sawdust and when dry they are dusted to remove particles of sawdust and lacquered with a good transparent lacquer. They are then placed into a warm oven and allowed to dry, after which the plate is ready for cutting up, that is, the 12 plates are now cut from the large plate. When cut up the plates go to the punch-press and the holes punched in and then the plates are ready for packing and shipping.

To produce brass letters and black background requires a little change in the operation. We will go back to where the plates are etched in the sheet. If, instead of the ground work being silver-plated, a black background is desired with brass letters we proceed

as follows: The plate, having been etched, is rinsed and removed to the black, though still retaining the enamel. When thoroughly black the plates are rinsed and dipped into the hot potash solution, which removes the enamel and backing, but does not affect the black oxidize in the ground. The plate is then rinsed thoroughly, dried as before and lacquered and finished as already described. If the silver letters are desired with a black background the plate may be silver-plated first, then coated with the enamel or sensitizing solution, or the plates may be slightly etched, then silver-plated and sensitized. The silver finish in both cases being different, as the first produces a finish similar to the Butler finish, and the other a sparkling matt finish. There are also a great many other pleasing combinations that may be had.

THE SOLUTIONS REQUIRED.

Now I will try to describe the various solutions used in this process. The first is the preparation of the wet-plate negative. This is quite a long process in itself and it is much better to have someone thoroughly familiar with "line work" handle this department, as it requires considerable skill and experience. I will, therefore, pass this process by, although, if the readers desire it, I will take it up and describe the various operations in detail at another time.

The next formula is the sensitizing acid resist or enamel. Many photo-engravers have their own pet formula, but they practically all strive for the same results, although the various proportions differ widely. It is simply a matter of getting acquainted with your formula and sticking to it, and not experimenting with each quantity that is prepared. The enamel or acid resist consists of the following:

Water (distilled)	8 ounces
Lepages glue	4 ounces
White of eggs	5 ounces
Bichromate of ammonia	140 grains
Ammonia, 26°	few drops

Beat the eggs up with four ounces of water, in three ounces more of water add the glue, and in the remaining ounce dissolve the bichromate salt and add the ammonia water. Mix all together thoroughly and filter through absorbent cotton. This solution should be kept in the red or ruby room.

The etching solution should consist of the following:

Powdered bichromate of potash or soda	8 to 10 ounces
Sulphuric acid	4 to 6 ounces
Water	1 gallon

The bichromate of potash or soda is dissolved in the water, after which the sulphuric acid is added slowly with constant stirring, and when the solution is cool it is ready for etching.

For deep etching, as mentioned, the chloride of iron may be used and can be purchased in this form. Chlorate of potash or hydrochloric (muriatic) acid should not be added where the enamel is used as a resist, as they tend to cause frilling of the enamel and thereby causing ragged edges. The enamel does not have the same resisting power to acid as does the asphaltum or gum process. The silver solution is prepared in a similar manner as that used in the plating business. The metallic silver is converted into chloride or cyanide of silver by dissolving the silver in equal parts of nitric acid and water, avoiding an excess of acid. When dissolved, dilute with hot water and precipitate with either sodium chloride (table salt), hydrochloric acid or potassium cyanide. If the latter salt is used for precipitation, care should be exercised, as the precipitate formed is soluble in an excess of the cyanide. The precipitate is washed with hot water and dissolved in potassium cyanide. The amount of free cyanide should be as small as possible, as an excess will affect the resist. Silver cyanide can be purchased on the market and it is much better to use this compound than to attempt to prepare this salt. It simply requires dissolving the silver cyanide salt in a solution of cyanide of potash.

The oxidizing solution consists of the following:

Copper carbonate (dry)	3 parts
Ammonium hydrate 26	7 parts

Thoroughly mix the above and then add 10 parts of water. This solution must not be strong, or it will remove the resist and coat the parts which are not intended to be oxidized. As soon as this solution becomes old it should be discarded and a new one prepared.

AMERICAN BRASS COMPANY REPORT.

The report of the American Brass Company of Waterbury, Conn., for the years 1914 and 1915 is as follows:

ASSETS.

	1914	1915
Real estate, machinery and tools., Jan. 1	$12,373,311.64	$12,858,197.24
Expended for permanent improvem'ts dur'g year	1,034,885.60	2,289,038.06
	13,408,197.24	15,147,235.30
Less—Charged off for depreciation	550,000.00	1,602,166.03
	12,858,197.24	13,545,069.27
Cash	2,017,501.15	2,662,795.82
Accounts receivable	2,545,601.52	5,943,571.67
Bills receivable	790,916.67	182,965.90
Woodlands	138,810.75	157,710.88
Stocks and bonds owned.	1,644,250.03	1,311,115.67
Patents	1,000.00	1,000.00
Merchandise raw, wrought and in process	6,624,904.84	7,987,052.12
	$26,621,182.20	$31,791,281.33

LIABILITIES.

Capital stock	$15,000,000.00	$15,000,000.00
Current accounts payable.	2,021,630.69	2,013,275.89
Reserve for contingencies.	1,000,000.00	2,000,000.00
Surplus	7,149,204.49	6,649,551.51
	25,170,835.18	25,662,827.40
Net earnings for year	1,450,347.02	6,128,453.93
	$26,621,182.20	$31,791,281.33
Surplus, January 1	8,049,204.49	8,599,551.51
Less dividends paid	900,000.00	1,950,000.00
	7,149,204.49	6,649,551.51
Net earnings for year	1,450,347.02	6,128,453.93
Surplus, December 31	8,599,551.51	12,778,005.44

THE DETERMINATION OF COBALT AND NICKEL IN COBALT METAL

DETAILED INSTRUCTIONS FOR PERFORMING THIS DIFFICULT CHEMICAL ANALYSIS.

BY C. A. KNITTEL.*

The only methods for the analysis of cobalt metal which the writer has been able to find in the literature are given by C. M. Johnson in his book, "Chemical Analysis of Special Steels, Steel-making Alloys and Graphites." Considerable differences between steel works chemists and this laboratory seem to show the desirability of further information on this subject. The following method has been employed in this laboratory for some time, duplicates checking within + 0.02%:

One gram of drillings contained in a 150 cubic centimeter conical flask provided with a trap[1] (made of a calcium chloride tube) is treated with 20 cubic centimeters of hydrochloric acid (S.G. 1.12). A gentle heat is applied until all action ceases. One cubic centimeter of nitric acid (S.G. 1.4) is now added to dissolve any remaining metallic residue. As soon as the action of the nitric acid ceases, the trap is rinsed, removed, and the solution evaporated to a syrup. The contents of the flask are taken up with 30 cubic centimeters of water and filtered. The silicious residue on the filter is washed with water (acidulated with a few drops of hydrochloric acid), incinerated and fused with five times its weight of potassium pyrosulphate. The fusion is dissolved in a little water and added to the main filtrate. The slightly acid solution of the metal is warmed and saturated with hydrogen sulphide. The sulphides of arsenic, copper, etc., are removed by filtration, thoroughly washed with acidulated hydrogen sulphide water (1 cubic centimeter hydrochloric acid: 100 water) and the filtrate caught in a 350 cubic centimeter casserole. To expel the hydrogen sulphide the contents of the casserole is evaporated low, the iron oxidized with a few drops of bromine, 0.2 gram ammonium chloride added, and the evaporation continued to dryness at water bath temperature. The dry chlorides are taken up in a little water, 0.1 gram of ammonium formate added, and the whole diluted to 50 cubic centimeters. The solution is heated until a precipitate of basic formate of iron separates; very dilute ammonia is now added until the solution is only slightly acid. After further heating for a minute or so, the precipitate of basic iron formate is allowed to settle, filtered and washed with a hot dilute (0.1%) solution of ammonium formate. The washed iron precipitate is dissolved off the filter with hot dilute (1:5) hydrochloric acid, the filtrate caught in the casserole in which the iron precipitation was made. The solution of the iron precipitate is neutralized with ammonia; ammonium formate added, and the iron precipitation repeated in a volume of about 50 cubic centimeters; the precipitate filtered and washed with the hot dilute ammonium formate solution. The united filtrates from the two iron separations are evaporated with the addition of 8 cubic centimeters concentrated sulphuric acid until fumes of sulphur trioxide are copiously evolved. The sulphates are taken up in water and transferred to a 180 cubic centimeter tall beaker, keeping the volume of the solution to about 50 cubic centimeters. Sixty cubic centimeters of ammonia (Sp. gr. 0.9) are now gradually added to the solution in the beaker (kept cool in running water) followed by 10 cubic centimeters of (20%) ammonium bisulphite solution. The cobalt and nickel are now deposited together with a current of 2.5 amperes. When the solution is colorless, the cover glass and the sides of the beaker are rinsed down with water, and the current reduced to 0.5 ampere allowed to pass until a few cubic centimeters of electrolyte tested with potassium sulphocarbonate show that the cobalt and nickel are completely deposited. The cathode is removed with the usual precaution, dried, and the deposited cobalt and nickel weighed. The cobalt and nickel are dissolved off the cathode with 30 cubic centimeters of nitric acid (1:3), the cathode rinsed, removed, and the solution of the metals boiled to expel nitrous fumes. The solution is diluted to 500 cubic centimeters, neutralized with ammonia, made faintly acid with nitric acid, heated to about 50-60° C. and the nickel precipitated with 30 cubic centimeters of a 1% alcoholic solution of dimethylglyoxim, followed by 10 cubic centimeters of (20%) ammonium acetate solution. The precipitate is allowed to stand for four hours, filtered on asbestos, washed twice with hot water, redissolved, and the precipitation repeated in a volume of 200 cubic centimeters. After standing for an hour in a warm place, the nickel precipitate is filtered into a Gooch crucible, washed with hot water, and dried at 130-140° C. for forty-five minutes. The weight of the precipitate multiplied by 0.20316 equals the nickel, which, subtracted from the cobalt and nickel found by electrolysis, gives the cobalt by difference.

NOTES AND PRECAUTIONS.

Cobalt metal as now commonly found in the market contains from 98-98.5% cobalt plus nickel. For this reason the amount of but 0.2-0.3 gram of material recommended by Johnson for the determination of the cobalt and nickel seems scarcely sufficient, as the weighing errors involved would appreciably affect the results. The indiscriminate use of large quantities of acids for solution and oxidation is to be condemned, as the getting rid of the excess only consumes time, and increases the chances of mechanical loss. In filtering the sulphides of copper, arsenic, etc., and the basic iron, one should choose the size of the filters with due regard to the volume of the precipitate to be filtered. The separation of iron as basic formate is preferred on account of the ease with which it can be washed, and the formates are completely decomposed on evaporation with sulphuric acid.

The presence of acetates in the electrolyte seems to retard the complete decomposition of the last traces of nickel. In one instance on electrolyzing material containing 97.5% cobalt and 0.8% nickel in the presence of acetates, 1 milligram of nickel was found in the electrolyte 30 minutes after complete deposition of the cobalt. The volume of the electrolyte should be kept within the limit specified above, as the complete deposition of the metals from such dilute solutions as employed by C. M. Johnson, is unnecessarily prolonged. Johnson saturates the electrolyte with hydrogen sulphide after deposition of the metals, and assumes that any precipitates formed consist of cobalt, but this precipitate is very often considerably contaminated with aluminum and manganese. It has been found that the amount of cobalt and nickel remaining in the electrolyte after electrolysis, as conducted in this laboratory, is less than 0.1 milligram,

*Chemist, The Coniagas Reduction Company, Limited, St. Catharines, Ont.
[1]Gosch Methods in Chemical Analysis.

amounting to less than 0.01% on a one gram sample. Hence the correction used by C. M. Johnson is not employed because its value is doubtful. The cathodes used are of the perforated type with an effective surface of 90 square centimeters. The anodes are spirals made of 0.04 inch wire, ⅝ inch diameter, 6½ turns.

CYANIDE vs. ACID PLATING SOLUTIONS

SOME CONSIDERATIONS IN FAVOR OF THE ABANDONMENT OF THE DUPLEX COPPER PLATING PROCESS.

BY CARL DITTMAR.*

The impetus given the plating industry by the abnormal price prevailing for copper and spelter which has compelled the manufacturer of metal goods to substitute copper and brass plated steel for solid copper and brass, has led the plating industry to investigate the merits of copper cyanide solutions as compared with acid copper baths.

Formerly, it was the practice, when a very heavy copper coat was required on iron or steel, to give the article a preliminary copper plate in the cyanide solution after which it was placed in the acid bath to obtain the heavy coat necessary. The reason for this preliminary deposit in a cyanide or alkaline solution was to protect the iron or steel from the action of the acid (alkaline solutions do not attack the surface of iron or steel and once the film of copper protects the iron base, the object could safely be put in the acid solution), this method of working necessitating, however, double equipment and double handling.

It is a well known fact that coper cyanide solutions yield about twice as much metal per current unit as an acid bath, provided, of course, the solutions are operated under correct conditions, that is, the bath must have a high metal content—it should be heated and agitated and should be worked with a minimum amount of free cyanide at a low current density. As in the past, however, cyanide plating solutions have been worked on entirely contrary conditions, the deposition of the average copper cyanide bath was lower per current unit than that obtained of an acid solution.

This state of affairs was primarily due to the fact, that in the past the plater has had to use metal salts of comparatively low metal content and containing large proportions of impurities and inert matter. It was necessary to use a greater proportion of free cyanide in order to overcome the internal resistance caused by the constant accumulating inert matter, and it was necessary to operate the bath at a much higher voltage. Under these conditions, acid solutions were almost universally used when a heavy deposit of copper was required.

Probably the first industry to consider the substitution of steel for sheet brass was the automobile industry. Formerly, automobile lamp reflectors were almost exclusively made from spun or stamped sheet brass, but when the abnormal rise in copper and spelter made it necessary for the lamp manufacturers to substitute steel, it was found that stamped or pressed steel, when properly copper plated, was not only equal to, but decidedly more economical than sheet brass. Then the manufacturer of automobile accessories, such as automobile bumpers, etc., took up the use of steel which was heavily copper plated and then nickel plated. In each of these instances copper cyanide solutions were used for the preliminary coat and were later suplemented by the acid copper solution to obtain the thickness of copper thought necessary.

This same method was pursued in connection with the heat treatment of steel. A method which is growing in favor among the automobile and allied industries is, to give certain parts of gears, cam-shafts, etc., a heavy deposit of copper in order to localize the carbonization during the heat treatment. While it was necessary that certain portions of automobile parts be hardened, it was also necessary that other portions of the same parts remain soft. The portions which were to remain soft were given a heavy copper plate as above mentioned prior to subjecting the entire part to the heat treatment. Thus, the copper plated portion remained soft, while the exposed part was carbonized as required and it was found that in order to prevent the penetration of the carbon a copper coat of the thickness of only 0.0005 would answer.[1]

It is a well known fact that copper cyanide solutions yield a finer, a more homogeneous deposit than is possible to obtain in an acid bath, and now that chemically pure metal salts are available—the plater is able to increase the metal content of his solution without materially increasing the specific gravity of the bath. With chemically pure copper cyanide it is possible for the plater to keep the free cyanide content down to a minimum, and with the lower current density is able to obtain the necessary deposit in less time than by the use of acid solutions formerly used.

A further advantage which the cyanide solution has over the acid bath is, that in the alkaline solution a uniform deposit is obtained in recesses and depressions, and for this reason the majority of automobile lamp manufacturers are using copper cyanide solutions to obtain the necessary copper deposit in the bowl of the reflector. It was found that with the use of acid solutions it was practically impossible to "throw in" the necessary amount of metal into the centre of the reflectors and the substitution of a copper cyanide solution operated warm and slightly agitated has overcome this difficulty.

For zinc plating, cyanide solutions are also gradually displacing the acid bath. While zinc cyanide solutions give thoroughly uniform and closely grained deposits, the plate obtained from an acid solution is of a crystaline and flaky nature. When the saving in cost of labor, handling, and the increased output obtainable with the cyanide solution is considered, one may safely say that acid solutions have seen their day.

*Trisalyt Department, Roessler and Hasslacher Chemical Company, New York.

[1]See "Case Carbonizing," a paper read before the American Society of Mechanical Engineers, by Marcus T. Lothrop, at the annual meeting of 1912.

SCARCITY OF COPPER IN GERMANY.

The daily press reports that the copper roof is being taken from the imperial castle at Donaueschingen, Germany, and will be used in the manufacture of munitions of war. This roof weighs many tons.

This is not the first time that metal has been requisitioned from an imperial residence. The Emperor's palace in Berlin was visited the latter part of September by the commission having in charge the seizure of metal for Government use, and a list of the metals at the Court was demanded. Emperor William ordered that all metals not in actual necessary use be seized. It was reported recently that the huge copper roofs of the cathedral at Bremen were being dismantled for military use.

SAFETY FIRST

A Set of Common Sense Rules for the Conservation of Life.

By G. W. Grupp.*

Modern industry has claimed such an alarming number of lives and limbs that it has become a serious question of national importance. Living in an age when machinery is being used more extensively and more persons being employed in industrial workshops accounts for the increase in the number of accidents. As a result the various legislatures have enacted laws for the preservation of life and limb.

Investigators have found that a large percentage of the accidents are preventable. Accidents being of vital importance to employer and employee, both ought to work in co-operation to make things more safe. Employees should make suggestions to their foreman where safety devices might be applied for the protection of life. And then the suggestions ought to be given proper consideration.

An employer ought never to ask a man to do a particular job for which he is neither fitted or trained. Men who are slow and heavy should never be given a job where a quick, alert and light person is required. Every employer ought to formulate rules explaining how the work can best be done with the least amount of danger and then distribute them amongst his employees.

It is only by a systematic and energetic educational scheme that men will be awakened to the imperative need that they must become more careful. Employers of labor therefore ought to place safety first signs about their establishment warning men of the dangers. Place red lights over dark and dangerous spots. And all exits should be marked with red lights, also display cards marked EXIT. Notices ought to be posted about the shop that running, wrestling, scuffling or engaging in any other kind of play is positively forbidden.

Safety signs and devices are useless if the men will not be careful. Men should warn each other if danger is near. And every employer should insist that his foreman or superintendent enforce all safety first rules among the workmen. And in the event of a violation of any of the rules, the employee should be punished in some way, and if he continues to be careless, fire him. He is a bad example for shop discipline. And if the men are found making short cuts across dangerous places they should also be discharged.

Unsuitable clothing has been the cause of a great many accidents to industrial workers. Men should be instructed to never wear a coat or shirt or jumper which has loose or ragged sleeves or to wear a flying cravat. Workmen should wear tight fitting clothes. Rolled up sleeves should never be permitted, cut them off. Men who work in the foundry ought to wear a sort of slip on shoe instead of laced ones, as practiced by some foundrymen. Muzzles ought to be worn in electroplating establishments so as not to inhale all of the poisonous fumes. Goggles should be worn by men working at polishing or buffing wheels while the wheels ought to be provided with hoods.

Then again, the plant should be sufficiently lighted. Insufficient light is bad for the workman. Stairways, elevators and especially dark places ought to be well lighted and the walls whitewashed or painted white. If natural light is not available, use artificial light.

The workman ought to have sufficient room in which to work, especially when working about machinery or vats or pans, etc., containing chemicals. Broad aisles are necessary in all dangerous places so that in the event of a fire or explosion there is sufficient gangway for the employees to escape without injury to one another.

Factories kept in an orderly condition are practicing safety first. Material should never litter all over the floor as some employee is always in danger of stumbling over the obstacle and injuring himself. Tools and everything in its place when not in use is a safe rule. Piling up stock with some system is always safer than piling it up in "any old way," as it is apt to topple over on some person when they least expect it. Employers cannot afford to take chances and the employees ought to have more common sense than to pile material up in a slip-shod manner. Employers ought to insist that things be done right. Everything done systematically, with passageways free from obstructions and the shop kept as clean as it is possible in an industrial establishment is good advertising for the firm. Employees need fresh air and the employer ought to provide a good supply. Foul air not only causes men to lose their mental and physical alertness but it also decreases their productive powers and thus become more apt to accidents. A ventilation system of some kind which will insure a constant current or change of air in the plant is essential.

Safeguards should be placed on all machines, belts, pulleys, shafts, gears and all projecting set screws should be cut off or guarded. It is not fancy safeguards that are wanted but guards which give protection. All appliances should be frequently and very carefully inspected so as to insure safety to the workmen. Stairways, platforms, overhead runways should be railed and well lighted. All elevators should have safety gates and a gong or some other signal on each floor to give warning when in motion. If the plant happens to be of more than one story, fire escapes ought to be provided. Fire drills are not a bad plan and should be practiced.

An employer ought to inform himself as to his legal duties and obligations; study the local labor and factory laws and post himself on the question of safeguarding machinery in his plant for the welfare of his employees.

No man should be allowed to work who shows the least signs of being intoxicated. In fact, men who are hard and steady drinkers should never be employed; also those who are subject to fainting spells or cramps, epileptics, deaf and those who have an impaired vision which has not been corrected.

Every plant should be provided with an emergency room which ought to be equipped with a stretcher, medicines, surgical instruments, bandages, towels, soap and all other things which are necessary in the treatment of an injury. The foreman or superintendent ought to be "FIRST AID" men so as to care for the injured until the doctor arrives.

And last, all accidents should be immediately and thoroughly investigated as to their cause and effect and then a provision ought to be made to prevent its being repeated. Get all the men to help carry out the safety crusade. Keep them constantly interested in the movement and the results will be wonderful.

*The Metal Industry staff.

EDITORIAL

OLD SERIES
Vol. 22. No. 2

NEW YORK, FEBRUARY, 1916.

NEW SERIES
Vol. 14. No. 2

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS.
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ANNOUNCEMENT

We announce herewith that George F. Garland, of Massachusetts, is no longer connected with THE METAL INDUSTRY, and no money should be paid to him. Send check or money order direct to THE METAL INDUSTRY, 99 John street, New York.

GRADE MARKING OF PLATINUM

The daily newspapers recently published reports that the National Jewelers Board of Trade was preparing a bill for passage by the New York State legislature regarding the marking of platinum goods. These reports are stated by De Witt A. Davidson, chairman of the platinum committee of the Jewelers Board of Trade, to be unofficial. He says that so far as he knows no such movement is under way. Furthermore the report referred to stated that a white gold was taking the place of platinum which contained nineteen parts of gold, four of palladium and the balance copper, etc. This alloy is not a platinum one, even if palladium does belong to the platinum group of metals. Any legislation regarding such an alloy would come under a gold schedule and not under platinum.

We are glad to learn that the reports mentioned above are not true, just because we believe that any legislation in regard to metals in general and to platinum in particular should be national and not local in scope; second, because we believe it would be a good thing, if when legisation was resorted to in the case of platinum, to pass a law prohibiting the use of platinum for jewelry at all! Platinum is not found in this country to any extent, the bulk of it coming from Russia and consequently the supply is limited. As platinum is a most valuable metal for industrial uses it seems foolish to waste it for ornamental purposes. The popular demand for it for jewelry just now is probably due more to its high price than to its ability to charm from an artistic standpoint. Diamonds set in other white metals such as nickel, silver, cobalt or even bright tin would make just as handsome an appearance and would sparkle just as brightly, but who wants diamonds set in tin? Everybody would if tin cost $50 per ounce!

However, if there is to be any regulation of the use of platinum, and if it is going to be used as at present, there will be urgent need of it, we believe that such regulation should be in line with the gold and silver stamping laws. Gold is worth 20 dollars, silver 60 cents and platinum 105 dollars per ounce, so there is much more reason to force users of platinum to stamp the goods with their real worth than for the users of the other two metals. It seems to us that it would be an excellent idea to have our Bureau of Standards at Washington draw up suitable rules and regulations for the uses and marking of platinum goods, bearing in mind that industrial uses should not be subordinated to dictates of fashion!

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

ALUMINUM TRADE CONDITIONS

To the Editor of THE METAL INDUSTRY:

The writer is tempted to reply to the contributor to your paper, who writes on a "Brief Resumé as to Conditions in the Aluminum Trade,"* and who styles himself "An Aluminum Man." The subject does not seem very well applied when one reads the article.

This "Aluminum Man" states that a number of trade papers have erroneously been quoting prices on aluminum, and, although you have in your footnote corrected this impression, we wish now to call attention to an error in the statement in this article regarding the price of aluminum which you have not corrected.

Your contributor states that the anomaly in price between the 31 cents per pound market of the Aluminum Company of America and the 55 cents per pound market quoted by the trade papers (which in fact truly represents the aluminum market) has arisen from the fact that the only American producer has refused to sell its aluminum for war purposes, but has steadfastly and constantly adhered to its policy of supplying its old customers in the United States with their needed supplies for their required line of business.

This creates quite a wrong impression, particularly as the writer of this article goes on to state that there have been two markets, a primary market, as it might be called, between the American manufacturer and the American consumer, and a secondary market between the foreign war office and such parties in the United States as have either resold their material obtained from the American manufacturer, or, as in the greater number of cases, have obtained scrap aluminum to supply the foreign demand. In other words, one would be given the impression from this article that the only people who found it necessary to buy aluminum on the 55 cents per pound market were those who needed it for foreign war purposes.

As a matter of fact, the Aluminum Company of America, while we believe they have been constantly endeavoring to take care of those people whom they had under contract, have been unable to take care of even these domestic contracts, forcing those domestic buyers who were not under contract, and even a great part of these who were under contract, but could not get deliveries, to buy in the open market, and to buy at the market price of aluminum in force, which market price is governed by the supply and demand of the metal, and this market price has been around the 55 cent level.

Your contributor would have it appear that the 31 cent level was the primary market, and that the market of 55 cents was only a secondary market. A market quotation is supposed to represent a price at which the commodity can be bought. Aluminum could not be bought either from the Aluminum Company of America or from anyone else during the period in question at 31 cents per pound, but it could be bought on the really existing market price of around 55 cents per pound.

We particularly want to correct the impression that has been made by this article in the statement that a secondary market existed between the foreign war office and such parties in the United States as have either resold their material obtained from the American manufacturer, or as has been true in the greater number of cases, obtained scrap aluminum to supply this foreign demand.

By far the greater part of all the aluminum recovered from scrap or aluminum received from the Aluminum Company of America by manufacturers, and resold because of the advance in market price, has gone to supply the domestic demand. While of course part of this metal has gone for foreign war purposes, the greater part of this metal has been used right here at home. The advance in the aluminum market from around 30 cents to 50 cents was not because of the foreign demand alone, but because of the demand from this country and lack of supplies, as well.

L. M. BRILE,
Sales Manager, United Smelting & Aluminum Company.
New Haven, January 17, 1916.

*January issue, THE METAL INDUSTRY.

ELECTROLYTIC ASSAY OF LEAD

To the Editor of THE METAL INDUSTRY:

I note in the November number of THE METAL INDUSTRY an article on "The Electrolytic Assay of Lead," by Ernest Lewis, F.C.S. Having had considerable experience with this method, using that excellent piece of apparatus designed by Perkins and modified by Price and Judge, I am surprised at the unnecessary high current and length of time given for the deposition, and in the case of spelter, the absence of details necessary for a correct assay. The lead in 5 grammes of all ordinary brasses and spelter can be completely deposited as peroxide in 15 minutes with a current of 1 ampere working with cold solutions. When 5 grammes of spelter (99%) are dissolved in 40 c.c. nitric acid (1:1), diluted to 150 to 200 cc. with hot water, then electrolyzed, using the above apparatus, the lead is not only deposited as peroxide on the anode, but some of it is deposited as metal on the cathode. Mr. Lewis appears to be unaware of this fact, and one very good book giving similar instruction, says: Any zinc that may form on the cathode can be disregarded, as it has no effect upon the deposit of peroxide on the anode. For a correct assay of spelter the cathode must be as clean at the end of the electrolysis as at the start, otherwise the assay will be considerably low. There are several methods of accomplishing this.

WALTER PRESTON.

Stoke-on-Trent,
December 22, 1915.

PUBLIC OPINION

TO THE EDITOR OF THE METAL INDUSTRY.

I wish to congratulate you on the January number which I have just received. To my mind it is away ahead of anything that you have so far issued. I appreciate the space that you have given the American Institute of Metals and believe that our membership will concur in this.

W. M. CORSE,
Secretary, The American Institute of Metals.
Buffalo, N. Y., January 18, 1916.

TO THE EDITOR OF THE METAL INDUSTRY:

My admiration for the success you have obtained in publishing such a wonderful issue as your January number compels me to offer my sincere congratulations.

You have set a high mark in the publication of articles and advertisements worth reading and if they are a promise of what is to be had for 1916 I cannot understand how any one connected in any way with the working of non-ferrous metals can do without your paper. GEORGE B. HOGABOOM.

New Britain, Conn., January 16, 1916.

TO THE EDITOR OF THE METAL INDUSTRY:

It is with no end of pleasure that I watch your paper grow. I have been watching for a good many years. Satisfying, careful, big, prosperous looking paper, covering every field thoroughly. This is what I hear from people I come in contact with. I feel that I owe you much consideration for past favors that I have received from the staff. W. N. NELLY.

Richmond Hill, L. I., N. Y., January 17, 1916.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE.

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

ALLOYING

Q.—We have a customer who desires an alloy having the strength, hardness and general working properties of brass, but it must contain no copper, nickel or lead, and large amounts of aluminum are also objectionable. Tin and zinc and small quantities of antimony are acceptable. Could you enlighten us as to the alloy that would be suitable?

A.—For an alloy having the properties such as you mention we would advise you to try the following:

Zinc	97
Tin	3

—K. Problem 2,251.

Q.—Kindly give us any formula for an aluminum alloy with the specific gravity not exceeding 3½ that will have an ultimate tensile strength of 28,000 pounds and a yield point of 18,000 with 7 per cent. elongation. Do you think this can be met with any copper alloy of aluminum?

A.—The tensile strength and yield point named can be had in an alloy of aluminum 70 per cent. and zinc 30 per cent., but this alloy has little or no ductility. If the percentage of zinc is reduced greater ductility may be had, but the tensile strength and yield point fall below the required figures.

An alloy of aluminum 93 per cent. and magnesium 7 per cent. has, at times, given the strength and ductility wanted, but this alloy requires such careful handling that it is not used in many brass foundries. Hence, it may be said that an ultimate strength of 28,000, yield point of 18,000, elongation of 7 per cent., and not over 3.5 specific gravity is hardly feasible in regular shop practice.

The alloy of aluminum 92 and copper 8, which is very generally used, seldom has an elongation of over 1 per cent., or an ultimate exceeding 22,000 pounds.—J. L. J. Problem 2,252.

BLUING

Q.—Will you kindly give us a formula for a solution for bluing steel articles by the chemical process? We wish to do this after the goods are highly polished.

A.—A solution for bluing steel by a chemical process should be made up as follows:

In 1 gallon of boiling water add 8 ounces of sodium hyposulphite. To the soda solution add from 2 to 4 ounces of acetate of lead previously dissolved in a little boiling water and mix thoroughly. The articles should be cleaned thoroughly as for plating and then immersed in the boiling solution for a few seconds or until uniformly blued. Afterwards wash and dry thoroughly. If the articles are not to be lacquered immerse them in hot paraffin oil (not kerosene). The paraffin oil will leave a film of paraffin wax upon the surface as the oil evaporates and will protect the finish.—C. H. P. Problem 2,253.

BRAZING

Q.—Will you give me a formula for a good solder to be used in brazing band saws? We have not as yet been able to find a satisfactory one.

A.—You might try the following formulas for a silver solder for brazing steel saws:

	No. 1.	No. 2.
Copper	33⅓	22
Zinc	16⅔	11⅓
Silver	50	66⅔

We believe that either one of these will answer your purpose, but possibly No. 1 will be the better of the two.—K. Problem 2,254.

CHEMICAL

Q.—I would like to ask come information regarding causterized soda, which I have noticed enters into the composition of some formulas, and also a certain firm sells a cleaning soap which calls for causterized soda 10 per cent. to be added to the soap, but they do not say what the soda composition is composed of. My understanding is that it is a composition of caustic soda and some milder soda like soda ash.

A.—Causterized soda ash is a concentrated dry soda ash containing 96 per cent. or less of sodium carbonate with small proportions of caustic soda. It is sometimes termed sodium monohydrade. But any soda ash will answer your purpose, the 58 per cent. variety being frequently used. It acts as a lubricator or softener for the water containing the soap chips used for ball burnishing.

Borax is also used for the same purpose but is a little more expensive than the soda ash.—C. H. P. Problem 2,255.

CLEANING

Q.—Could you give me particulars of a process for electrically pickling black steel sheets, such as are used for galvanizing purposes?

A.—The removal of scale or oxides from sheet iron or steel or from forgings made from the same materials is very successfully removed by electrolysis in a fraction of the time consumed by ordinary pickling solutions. For such a purpose a solution should be arranged as a regular plating solution, preferably in a wooden tank, the anodes should be of sheet lead and the cathodes the articles to be cleaned.

The solution should consist of a 5 to 10 per cent. solution of sulphuric acid in water, heated to a temperature of 160 to 180 degrees Fahrenheit. The voltage should not be less than six and the amperage as high as possible. The removal of the scale is due to the copious evolution of hydrogen, so the more rapidly this gas is developed the quicker the removal of the scale.

Niter cake, a by-product in the manufacture of nitric acid, is being used quite extensively at the present time for removing oxides from the ferrous and non-ferrous metals. This material consists of a crude sodium bisulphate or rather a pyro-sulphate of sodium. One or more pounds of the material should be used per gallon of water. The solution should be slightly acidulated with sulphuric acid; one or two per cent. will be sufficient. The temperature should be 160 to 180 degrees Fahrenheit. In many instances the addition of the acid may be omitted.—C. H. P. Problem 2,256.

FINISHING

Q.—Kindly advise how to get a rich red bronze on copper medals. I have been using sulphate of copper and sal ammoniac, also sulphur of liver, but could not get proper results.

A.—To produce a red bronze on copper proceed as follows: Dissolve in 1 pint of boiling water ½ ounce of sulphate of copper; then neutralize the solution by the addition of caustic soda and add ½ ounce of finely divided oxide of iron. (What is known as jewelers gold rouge will answer the purpose). Now immerse the medals in the turbid solution for 10 to 15 seconds; remove, drain well and heat in an iron plate for a short time. When cool brush the surface with a soft brush to which is applied a little beeswax.

You can also use the sulphate of copper and sal ammoniac dip as follows: After immersing remove and dry; then wax the surface. This can be done by dissolving beeswax in turpentine by the aid of heat. Apply a very small amount of the dissolved wax to the surface of the medals with a soft cloth and afterwards

apply dry sanguine of the required shade to a brush and go over the medals. This will give you the red metallic lustre. The sanguine may also be applied with a cloth.—C. H. P. Problem 2,257.

GLUING

Q.—Will you kindly answer the following questions pertaining to ground emery glue: First—What could be used to mix with glue while cooking to eliminate the bad odor which arises from the glue. Something that will not impair the adhesive qualities of the glue and still remove the odor?

Second—What is the best test for determining a good grade of ground emery glue from a poor grade other than cooking it and trying it? Is there not some way that it can be determined as to quality which can be accomplished more quickly?

A.—The odor from your glue might possibly be due to a glue of a character not suited to your work, but is likely to be the result of the accumulation of stale glue around the glue pot.

Any good grade of hide glue costing 15 cents or more a pound (when buying from responsible concerns, the price usually indicates the quality of the glue) should, if worked when fresh, always be perfectly sweet. Glue should never be kept under heat more than four hours, for after that time it becomes rotten, you might say. In other words, it loses its good properties and might better be emptied out of the glue kettle than used. Glue is simply animal matter boiled up, and if allowed to remain under heat too long, the same thing happens to it as would happen to the carcas of a dead animal lying in the sun, which, after a certain length of time, putrefies and rots.

We find from experience that people do not appreciate what it means to handle glue and they do not realize that when fresh glue is put into a glue pot around the sides and in which there is an accumulation of old dead glue, that the old glue immediately contaminates the fresh glue, and it is the presence of the old glue under the heat which creates the odor.

In answer to your second question, there is no way to tell a good grade of ground emery glue from a poor grade other than by cooking and frying it, unless a person is familiar with all the fine points of glue panufacture and knows the difference between various glues. This could come only from experience.

Would suggest that you take care of the question of the accumulation of dead glue by the use of aluminum pots instead of copper, as aluminum is greasy enough by nature so that glue will not stick to it. Also, instead of using one large glue pot, arrange a series of small pots, the contents of which should be used up inside of the four-hour limit by keeping a continual rotation of the small pots. This, you see, insures fresh glue always. To eliminate the trouble of overheating the glue and cooking its strength all away at excessive temperatures, equip the heater with a thermostat heat regulator, which will keep the glue always at the proper temperature.—B. H. D. Problem 2,258.

GRINDING

Q.—Kindly advise me what to use in grinding down babbitt on bearing caps. I am about to install a small motor with a steel face plate or wheel attached at the side and use coarse emery paper and beeswax, but I am afraid the babbit will clog up the emery paper.

A.—Use round steel face plates the same as used on Gardner grinders and purchase round emery discs the same diameter as the plate. Also get a special can of cement for attaching. Manufacturers of grinders carry in stock these discs from No. 8 to 120 grade. I believe that No. 50, 60 or 70 grain will suit your purpose. Use a piece of pumice stone to clean the babbitt from the wheel when it chokes up.—P. W. B. Problem 2,259.

MIXING

Q.—Please favor us with a mixture for an acid resisting alloy.

A.—The following formulas will give an acid resisting alloy:

Copper	76	78
Lead	12	15
Tin	12	15
Zinc	1½	2

—K. Problem 2,260.

PLATING

Q.—Will you kindly advise us if plating by a rectifier, electrically or chemically, has ever been accomplished by any one, and if so whether it is a success or not. Also is there any economy in its use and is it as reliable as a dynamo?

A.—Transformers are used to change the voltage of a 110 volt or more circuit to a lower voltage and give a corresponding amperage suitable for plating purposes. Chemical rectifiers have also been used for the same purpose.

There is no economy in such methods, but a greater expense in the electrical energy to gain the desired change. The method is no doubt reliable, but the dynamo of low voltage and corresponding amperage, high or low, will continue to be used until some method of development by storage batteries can be utilized without the use of mechanical energy in any form to maintain a constant flow of electrical energy without deterioration.

Until such a time water power developed into mechanical energy and then to electrical energy by the use of the dynamo will prove to be the cheapest source of energy. Following the water power, steam is the next best equivalent.—C. H. P. Problem 2,261.

Q.—Please let me know which is the best way to take iron out of an acid copper solution and also what is good to make such a solution conductive.

A.—To remove iron from an acid copper solution is a difficult proposition. Iron will not harm the solution. When solutions contain too much acid iron chips are frequently used to overcome it. Some platers claim to obtain better results when the solution contains small proportions of iron. Single nickel salts are also used and some of the best deposits are obtained from acid copper solutions that contain 1 ounce of single nickel salts per gallon of solution.

As a conductor add 2 to 4 ounces of sulphate of aluminum per gallon of solution and ⅛ of an ounce of black molasses.—C. H. P. Problem 2,262.

PUNCHING

Q. What is the correct speeds and pressure to operate presses with cutting dies on metals? For punching and shearing metals the kind of material being worked and its thickness must be given consideration.

A. For metals not over ¼ inch thick, the speeds usually run between 50 and 200 strokes per minute. The cutting pressure required depends upon the shearing strength of the metal, and of the actual area of the surface being served. To allow for some excess pressure the tensile strength may be substituted for the shearing strength, and may be roughly assumed as follows: Bronze, 40,000 pounds; copper, 30,000 pounds; aluminum, 20,000 pounds; zinc, 10,000 pounds; tin and lead, 5,000 pounds.—P. W. B. Problem 2,263.

RESISTING

Q.—Can you advise me of a good non-conducting covering for plating racks? One that will resist the action of hot lye and electro cleaners.

A.—It is almost impossible to apply a material to plating racks that will withstand the action of an electro cleaner and hot lye solutions. Enameled frames similar to cooking utensils would answer the purpose but they would have to be made from steel to withstand the heat of the firing operation. Bakelite is unacted upon by acids or alkalis even in solutions heated to the boiling temperature. Two or three coats of this lacquer upon the frames and baked at a temperature of 300 degrees would prove to be a good protective coating.

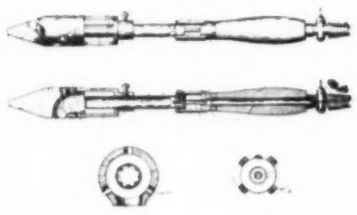
A method used in a large plant is to use porcelain insulators such as used in carrying wires through partitions, etc. These insulators vary from 1 to 4 inches in length and carry quarter-inch covered wire. In making up frames these insulators could be used in sections, but the frames if made up from brass rods, etc., should be arranged so that the insulator makes a tight fitting sleeve upon it. In this manner the frames can be protected to such an extent that very little metal will be deposited upon them.—C. H. P. Problem 2,264.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST.

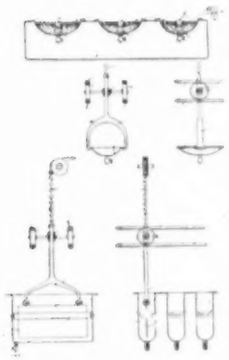
1,165,897. December 28, 1915. **Soldering-Iron.** Amie V. Paquette, of Chicago, Ill., assignor to L. B. Allen Company, of Chicago, Ill., a corporation of Illinois.

One object of the invention is to provide an improved soldering iron, as shown in cut, by which heat from the flame, besides being utilized to keep the soldering point hot, will be deflected onto the work so that the latter will be thoroughly heated in advance of the application of the soldering point. By thus utilizing the heat, the work will be thoroughly heated in advance of the application of the soldering iron and thereby an effective uniform heat will result between the solder and the work, because the solder will more readily adhere to a heated surface than an unheated surface. By thus preheating the work, the soldering operation will be greatly facilitated, because it will not be necessary to work the point of the iron back and forth over the solder. The invention further designs to provide an improved self heating soldering iron.



1,165,920. December 28, 1915. **Process of Coating Iron with Aluminum.** Sodamasa Myaio, Tokyo, Japan.

This invention has for its object to provide an improved process, as shown in cut, for coating iron sheets, rods, wires or other iron articles with aluminum. Iron coated with aluminum is particularly useful for a variety of industrial purposes as it is thereby rendered free from oxidation.



With the improved process of this invention aluminum is caused to adhere direct to the surface of the iron in a perfect manner so that it will not come off or tarnish or corrode under the action of air, water or heat or be stripped off by mechanical action because my improved process enables the metal to be directly covered with a layer of pure aluminum in place of the zinc or tin alloy hereinabove described.

According to the invention the iron articles to be coated with aluminum are first tinned or galvanized, that is to say, are coated with tin or zinc in any well known manner and they are then immersed in one or successively in two or more vessels containing molten aluminum and while so immersed the surfaces of the articles are swept by steel brushes. The articles are finally pressed or rolled to give them a smooth surface.

1,166,721. January 4, 1916. **Method of Treating Impure Bismuth Metal.** Walter C. Smith, of Chrome, N. J., assignor to United States Metals Refining Company, of Chrome, N. J., a corporation of New Jersey.

The invention relates to a method or process of treating bismuth bearing ores or metallurgical products containing bismuth for the recovery of the metallic bismuth contained therein.

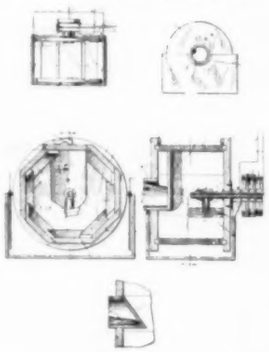
The object of the invention is to provide a novel and improved method or process which will enable a high percentage of the bismuth contained in the materials treated to be recovered, more economically, and of greater purity than heretofore.

The patent covers:

The method of treating impure bismuth metal or metals containing a high percentage of bismuth, consisting in subjecting the molten metal to the action of an alkali as caustic soda, removing the impurities separated thereby, dissolving zinc in the molten metal, removing the alloys formed between the zinc and impurities in the metal, bringing the metal to a molten condition, lowering the temperature until the material begins to crystallize, and removing the bismuth crystals so formed.

1,164,932. December 21, 1915. **Plating Machine.** J. A. L. Deters, Chicago, Ill.

This invention relates to electro-plating machines of the type known as plating barrels, and has for its object a construction, as shown in cut, whereby the articles may be thoroughly and efficiently plated and then automatically removed or discharged from the machine or barrel.

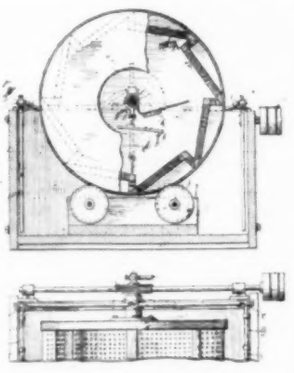


The patent covers:

A device of the class described comprising a tank containing plating liquid, a plating barrel rotatably mounted in the tank and adapted to contain the articles to be plated, said barrel being perforated to permit the passage therethrough of the plating liquid, an anode of suitable plating metal arranged within the barrel, separate electric conducting wires suitably connected to the anode and the articles to be plated, and means for ejecting the plated articles from the barrel including a tubular bushing in said barrel and a blade obliquely arranged within the barrel and adapted to eject the plated articles through the opening in the bushing.

1,165,346. December 21, 1915. **Plating Machine.** Louis Schulte, Chicago, Ill.

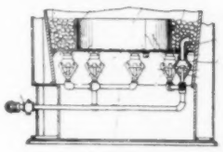
This invention relates to electroplating machines and more particularly to that class of plating machines which are adapted to receive a plurality of small objects each to be plated, which objects are suitably agitated and moved around so that plating may be effectively done throughout all of their exposed surfaces.



The invention accomplishes a number of desirable objects among which might be mentioned the ease and simplicity with which the machine may be charged and the articles withdrawn therefrom; the provision of means to suitably turn over or agitate the articles to be plated instead of causing them merely to slide upon an unbroken surface; improved features for conducting the current into the electrolyte and to the articles to be plated; and various other objects all as will appear more clearly from the accompanying illustration.

1,166,470. January 4, 1916. **Gas Furnace.** Robert A. Merrill, of Cincinnati, Ohio, assignor to the Eagle White Lead Company, of Cincinnnati, Ohio, a corporation of Ohio.

This invention relates to improvements in heating furnaces of the type employing gas as fuel and has for an object to produce a burner, as shown in cut, which insures a thorough admixture of air with the gas to be burned.



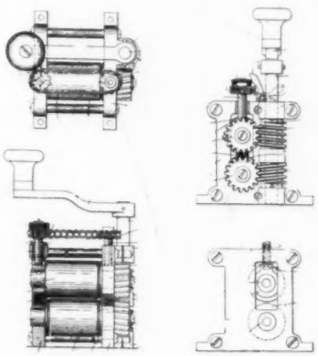
A further object is to produce a gas burner for heating furnaces, which is adapted to distribute the flame as it issues from the burner, so that a more uniform area of flame is presented to the surfaces to be heated.

The patent covers:

A gas burner attachment for heating furnaces comprising a series of angle plate sections adapted to be secured to the walls of the furnace fire pot, said sections forming an annular incombustible fuel container, with a centrally disposed air passage, a series of burners secured to each angle plate, said burners communicating with separate fuel supply pipes, and consisting of a gas nozzle, an air intake hood surrounding the gas nozzle, and a mixing tube secured to the hood, said mixing tube having its discharge end turned toward the wall of said fire pot and flared to produce a relatively wide flame.

1,167,567. January 11, 1916. **Rolling Mill.** J. A. Jerome, Montpelier, Vt.

This invention relates to a mill for reducing a metal plate or strip by successive passes of the same between rolls which are relatively adjustable to vary the width of the nip of the rolls.



The invention is intended particularly for gradually reducing the thickness of a plate of precious metal, such as gold, to prepare the metal for use by dentists, and for this use is embodied in a mill of relatively small size, the rolls being manually driven.

The invention has for its object to provide simple, durable and compact means for simultaneously rotating the rolls in opposite directions, as shown in cut, said means being unaffected by nip-varying adjustments of the rolls, and adapted to utilize to good advantage hand or other power applied to rotate the rolls.

1,167,641. January 11, 1916. **Finish Remover.** Carleton Ellis, of Montclair, N. J., assignor to Chadeloid Chemical Company, of New York, N. Y., a corporation of West Virginia.

This invention relates to removers and relates especially to removers comprising carbon-tetrachlorid or other chlorinated or other solvents and prepared by the incorporation of suitable salt thickeners such as acetates in alcohol or other finish solvent material, thereby producing esterification or condensation products, if desired, with the incorporation of suitable strong sulphuric or other acid material.

The patent covers:

A finish remover comprising benzol, alcohol and an organic salt of sodium as a thickener.

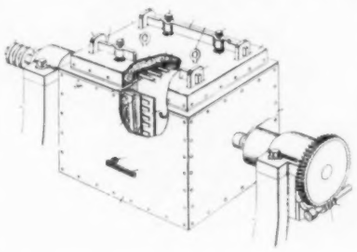
A finish remover consisting largely of composite volatile organic solvent material, including a penetrating solvent and a crystallizable metallic salt of a fatty acid incorporated therewith.

A finish remover comprising organic volatile finish solvent material and a crystallizable organic salt of a metal incorporated therewith.

1,169,529. January 25, 1916. **Process of Sherardizing.** Edgar F. Collins and John A. Capp, of Schenectady, N. Y., assignors to General Electric Company, a corporation of New York.

This is an improvement over the sherardizing process and for which the inventors' claim is:

1. The method of sherardizing which consists in submitting the articles to be sherardized to the action of zinc dust or powder containing not less than 80 per cent. nor more than 92 per cent. metallic zinc, the remainder being mainly zinc oxid while maintained at a working temperature which does not fall below 350 degs. C. nor rise above 375 degs. C.



2. The method of sherardizing which consists in so correlating the composition of the zinc dust or powder and the working temperature of treatment that the percentage of zinc in the dust lies within the limits of about 80 to 92 per cent., while the temperature of treatment lies within the range between about 350 and 375 degs. C.

3. The improvement in the art of sherardizing which consists in maintaining the sherardizing temperature (in the furnace shown in the cut) so that it does not exceed 375 degs. C. or fall below 350 degs. C., while the zinc dust is maintained substantially free from impurities and with a percentage of metallic zinc within the limits of 80 to 92 per cent.

1,169,536. January 25, 1916. **Alloy.** Edward D. Gleason, of New York, N. Y., assignor to New Metals and Process Company, of Brooklyn, N. Y., a corporation of New York.

This invention relates to the purifying and casting of copper and alloys thereof, the object of this invention being to eliminate oxygen and other gases which if allowed to remain render such castings porous.

The inventor says:

"In practising my invention I incorporate boron in copper, as graphite exists in cast iron, by fusing them in a crucible, free from impurities, with a flux consisting of native calcium fluorid and fused boracic acid. For instance, in a crucible of magnesite, or graphite free from arsenic balls, I put three parts of calcium fluorid and, on top of that, one part of fused, vitrified boracic acid. I then fuse the same, preferably in an oxy-hydrogen furnace of ordinary commercial type, until the fused mass of said two ingredients has reached the proper consistency, which is manifested by dense fumes of boron fluorid arising from the crucible. I then pour into said fused mass molten copper at a temperature of about 2,500 degs. F. or higher. Thereupon, the boron fluorid permeates the molten copper and when the latter is cooled the boron exists therein as graphite exists in cast iron."

1,169,392. January 25, 1916. **Composition of Copper Alloys and Process of Manufacturing the Same.** F. C. Frary, Minneapolis, and Sterling Temple, of St. Paul, Minn.

This invention has for its object to provide an alloy of copper having certain desirable properties, particularly hardness.

In carrying out the invention, the inventors alloy with the copper a metal of the alkaline earths (calcium, barium, strontium and magnesium) and find that by the use of a very small quantity of the metal of the alkaline earths the hardness of the copper may be materially increased. As examples of such alloys, they have made alloys of copper containing less than one per cent. of each of the above-named metals (calcium, barium, strontium and magnesium), and find these alloys to make sound castings which are harder than pure commercial copper, and of high electrical conductivity.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST.

UNITED SMELTING AND ALUMINUM COMPANY

By L. M. Brile.

The United Smelting and Aluminum Company, general office and works, New Haven, Connecticut, has become a leading factor in the production of all grades of aluminum for foundry purposes, automobile use, steel manufacture and kindred uses. The enormous demand for its products, necessitated the erection of a new plant, and the installation of additional and more complete equipment. Seventeen blast style, coke fuel, melting furnaces are in constant operation, producing an output of fifteen to twenty thousand pounds per day of aluminum ingots and alloys of all grades.

The company's number one grade is made from the best virgin sheet clippings only, and has become a standard for purity. A recent analysis made at the plant of the Crane Company at Bridgeport, Connecticut, showed the following constituents:

Copper	.16
Aluminum	98.75
Silicon	.11
Iron	.56
Manganese	.42

A still more recent analysis taken on an export order for one of the warring powers, analyzed by the representative chemist at the plant of the company at New Haven, drillings from thirty ingots having been picked at random, showed an aluminum content of 99.20% and an iron content of less than .25%.

*THE NEW PLANT OF THE UNITED SMELTING AND ALUMINUM COMPANY AT NEW HAVEN, CONN.

Special attention is given by the company to the manufacture of aluminum alloys for foundry purposes. The standard number 12 alloy is probably the best known and most widely used of all casting alloys. Number 12 contains a minimum of 92 per cent. aluminum and seven or eight per cent. of copper, according to the preference of the founder or to his special needs. The usual allowance for variation from this analysis is one per cent. although recent analyses have shown a divergence of less than one-half of one per cent. The company is also specializing on an alloy designated by the trade name casting alloy ingot, which contains about four per cent. of zinc and eight per cent. of copper, balance aluminum with the usual variation allowance. This grade has found a ready market among the foundry trade, and a great many larger foundries prefer it to the standard number 12. While slightly heavier than number 12, it produces perfect castings, and

*Some interior pictures of this plant were shown in the January issue of The Metal Industry.

in durability, tensile strength, and wearing qualities, it is equal, if not superior, to any aluminum casting alloy.

The cause of so many defective aluminum castings is an excess in the metal of aluminum oxide or "alumina." The foundryman will often attribute the fault to an excess of zinc or iron in his alloy, or is often made to believe that he has overheated his metal, or that there has been some other fault in his foundry practice, while as a matter of fact his methods were all right, and a chemical analysis of the alloy used would show it to be what the foundryman ordered, still in the presence in the alloy of excessive oxide (which shows in the ordinary chemical analysis as metal) lies the whole trouble.

The foundryman may receive a shipment specified as number 12 aluminum alloy, and he may even have it analyzed with the result that it measures up to number 12 specifications, and yet have an abundance of trouble with defective castings, due to "alumina" or oxide. The foundryman who does not know will very promptly lay the cause to a variation of analysis—or to the presence of zinc or iron (if he has not had the metal analyzed first, which is generally the case) when as a matter of fact, zinc has a greater affinity for aluminum than copper and the presence of zinc in aluminum alloys does not deteriorate the value of the alloy for casting purposes, only adding to the weight according to the proportion used; an alloy containing from two to five per cent zinc and copper about six to eight per cent. is an excellent casting alloy, and can be used with the best of success for most commerial castings. Zinc then can be eliminated at once as a factor in causing the defectives.

Iron may be a cause if found in any alloy in a proportion greater than one per cent. or so, but in a preponderance of cases the trouble is aluminum oxide—nothing else. The elimination of this deteriorating element has had the greatest consideration, care and a great deal of the research work has been done and extensive experiments made at the company's plant in order to do away with it.

It was early apparent that one of two methods would have to be used—either we would have to use a closed retort, preferably of the reverberatory type or find some means of preventing the air from striking the molten metal if open furnaces, of the crucible type or otherwise were used. Our experiments were finally concluded after it was demonstrated that we could produce pure aluminum ingots and alloys absolutely free from "alumina" or oxide of aluminum by both of these methods. The necessary trade precautions will not permit me to explain more in detail how this prevention was accomplished, but we feel it is of great importance to the foundry trade. First: To know the exact cause or the exact cause in most cases of continued defects in aluminum castings. Second: To know that a chemical analysis can not be used as a criterion, in determining whether the metal is suitable or not. Third: To know that aluminum free of oxide can be and must be furnished.

A CORNER OF THE BUSINESS OFFICE OF THE UNITED SMELTING AND ALUMINUM COMPANY AT NEW HAVEN, CONN.

The company also manufactures a special alloy, designed for the use of stove manufacturers and foundries for the making of master patterns and match plates. This alloy was designed after a careful study of the special requirements of the stove manufacturers, and the particular requirements needed in the manufacture of match plates. The standard grade number 31 alloy is also manufactured by the company. This is an alloy high in zinc, where lightness is not so important. For a great many cheaper castings, this makes an ideal alloy.

For the steel trade the company manufactures a special number 2 aluminum ingot, being an alloy used as a clearing agent in the making of open hearth steel. Also, the company manufactures for steel requirements, granulated or shot aluminum. The manufacture of granulated aluminum is similar to the manufacture of shot, and is produced by pouring the molten

metal from a platform from a high level, the molten metal striking the water forming a small granule about the size of a bean.

The equipment of the company consists of separators, crushers, dryers, conveying equipment, overhead tram rail carrying devices, sifters, riddles, etc., etc.

The new building of the company is designed in such a way as to give a maximum of floor space, light and comfort to each department. It is built in two sections. In one section the offices are laid out, allowing the erection of a reception room and three private offices on one side, with the general offices and directors' room extending the length of the other side. A narrow hallway intervenes, several doors on either side allowing access to either the general or private offices. Directly in back of the offices is a large spacious storage room, where shipments after being weighed and sorted, are properly marked ready to find their way into the foundry, which is just in back—extending across the entire length of the building, seventeen furnaces being in constant operation. Here also is the overhead carrying system, the pots filled with molten metal being pulled from the furnaces, and with the greatest ease moved to the proper pouring station. The other section of the building is the receiving and shipping department, and also a storage room for new stock of ingots, sheets, rods, etc.

On the upper floors are located the laboratories of the company, and the preparation department, in which the material is made ready for the furnaces. The laboratory occupies the front wing, and the preparation department is in the rear end. Here are located the dryers, separators, crushers, shears, etc. The material is prepared here, ready for the fires, and is then lowered into the melting room by conveyors. The basement floor of the building is also used for the storage of material, which is conveyed by an electrical elevator to the preparation department, and from there to the melting furnaces. The directorate of the company consists of Abe, Louis, Harris and Michael Lapides L. M. Brile, for a number of years with the U. S. Reduction Company of Chicago, is sales and advertising manager., The company maintains offices at 830 Penobscot Building, Detroit, Michigan, for the convenience of the trade in that section.

HARDENED COPPER

The illustration shows one of the many applications to which the metal now being manufactured and sold under the name of Hardened Copper by S. R. Dawson of New York, N. Y. may be put. The castings shown were made in a mold procured from a specimen of Irish kale and it is interesting to note how faithfully the foliage of the kale has been reproduced in cold metal.

Front. Back.

IRISH KALE REPRODUCED IN DAWSON HARDENED COPPER.

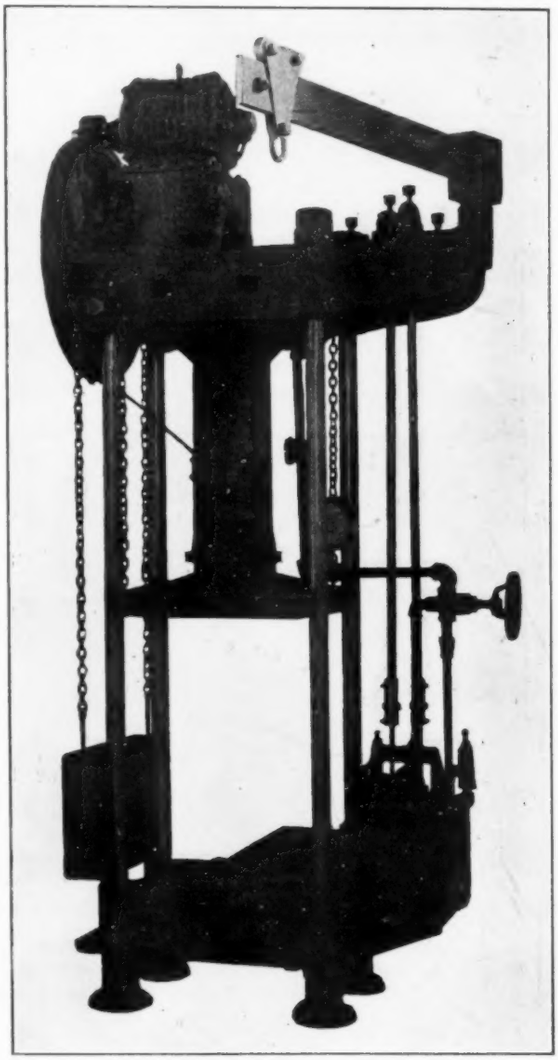
Alfred Lenz, a sculptor of New York, made these castings by means of a new method which he has lately brought out and which is a development of the lost wax process, concerning which a number of articles have been published in THE METAL INDUSTRY from time to time.

The metal from which these castings were made is claimed by the inventor, to be superior to all other metals for high speed journal bearings and frictional uses. He states that it is superior to case hardened steel for locomotive links and link blocks. The metal is not affected by salt water and consequently can be used for all kinds of marine work.

The process whereby Dawson copper is produced is the secret of the inventor, but Mr. Dawson states it to be one of the features of the process that, after the metal has been once treated by him it may then be transported anywhere and remelted any number of times without a change in its quality.

60 TON FORCING PRESS

The hydraulic press illustrated by the accompanying photograph is a new design of inverted hydraulic forcing press brought out by The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio. It is used in machine, railroad, automobile and repair shops as a general utility press for forcing work. The



THE 60-TON PRESS.

press is a self-contained unit which requires no auxiliary water or power supply. It is driven by an electric motor.

The illustration shows the press equipped with a two plunger vertical hydraulic pump whose plungers are ⅝-inch in diameter and have a stroke of 3½ inches. This pump is driven through two eccentrics which are operated by a three horse-power motor mounted upon the press. The gears of the motor power attachment are fully enclosed. The pump is equipped with an automatic knock-out valve attachment, spring safety valve, tee operating valve and pressure gauge.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS.

AMERICAN ELECTRO-PLATERS' SOCIETY

(AN EDUCATIONAL SOCIETY.)

President, W. S. Barrows, Toronto, Canada; Secretary-Treasurer, Walter Fraine, 507 Grand Ave., Dayton, Ohio. All Correspondence should be addressed to the Secretary. The objects of this society are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. The Society meets in convention in the spring of each year, subject to the decision of the executive committee. The next convention will be held at Toronto, Canada. The branch associations hold monthly and semi-monthly meetings in their various cities.

Milwaukee Branch.—Ernst C. Yaeger, secretary, 962 Ninth street, Milwaukee, Wis.

The meeting place of the Milwaukee Branch has been changed from Eagles Hall, 137 Second street to the West Side Bank Building, Third and Chestnut streets, and on January 7 this branch held a smoker as an opening for the new hall.

Philadelphia Branch.—Philip Uhl, secretary, 2432 North 29th street, Philadelphia, Pa.

The regular meeting of this branch was held Friday evening, January 7, and was conducted by the president, Mr. Barr. After the regular society business, D. A. Metz exhibited samples of bright nickel on white metal toilet articles produced by the use of a hot copper cleaner, and also gave a very interesting and instructive talk on method of producing the finish. The first February meeting was held on the 4th, at which a discussion of brass plating took place.

Toronto Branch.—Ernest Coles, secretary, P. O. Box 5. Coleman P. O., Toronto, Ontario, Canada.

The Toronto Branch held its regular meeting on January 27. After the regular routine business a discussion on zinc plating and cleaners was held. Dr. Lash Miller of the Toronto University and an honorary member of the branch was present at this meeting and his opinion was sought on points where chemical action was not quite clear.

New York Branch.—William Fischer, secretary, 345 East 23rd street, New York, N. Y.

The regular monthly meeting of the New York branch was held at its rooms, 258 Pearl street, New York City, Friday evening, January 28. Ernest J. Hapgood, connected with the General Electric Company, West Lynn, Mass., and Martin G. Scholar, with the E. W. Bliss Company, Brooklyn, N. Y., were elected to active membership. Stewart Marshall gave an interesting demonstration on the analysis of nickel solutions. It is reported that preparations are complete for the annual banquet of this branch which is to be held February 19, 1916 at 8 p. m. at the Broadway Central Hotel, Broadway near Fourth street, New York, N. Y. A number of firms have already taken space for exhibiting lines of platers' supplies and apparatus. It is reported that some handsome souvenirs will be given out. In addition to the speakers mentioned in the January issue of THE METAL INDUSTRY, it is expected that Founder Charles H. Proctor will be toastmaster. Tickets at $1.50 each may be had from the secretary.

St. Louis Branch.—F. C. Rushton, secretary, 4405 Blair avenue, St. Louis, Mo.

The third annual banquet of the St. Louis Branch was held at the American Hotel, January 22, and was attended by a great number of members of the branch and their wives. After the banquet had been served E. J. Musick, chairman of the committee of arrangements, introduced President H. H. Williams who, after an address of welcome and a review of the work accomplished for the past year, took charge of the program which was as follows: Regal Trio, song; H. J. Richards, "As Editor of the Monthly Review," and who, in his usual humorous manner created a great deal of laughter; C. B. Lord, general superintendent of the Wagner Electric Manufacturing Company, "Foreman Psychology"; Edwin W. Heil, of Wichita, Kan., "The Benefits to the Isolated Plater of Belonging to the Society"; Regal Trio, song and short talks were given by H. E. Willmore, of the Chicago Branch, C. H. Proctor, founder; Colonel H. J. Hansjosten, past supreme president; Lee W. Van Cleve, president of the Buck Stove & Range Company, and Frank P. Rushton, secretary of the St. Louis branch.

Telegrams were received from W. S. Barrows, supreme president, who was unable to attend on account of illness and from the Chicago branch, sending greetings and wishes of success.

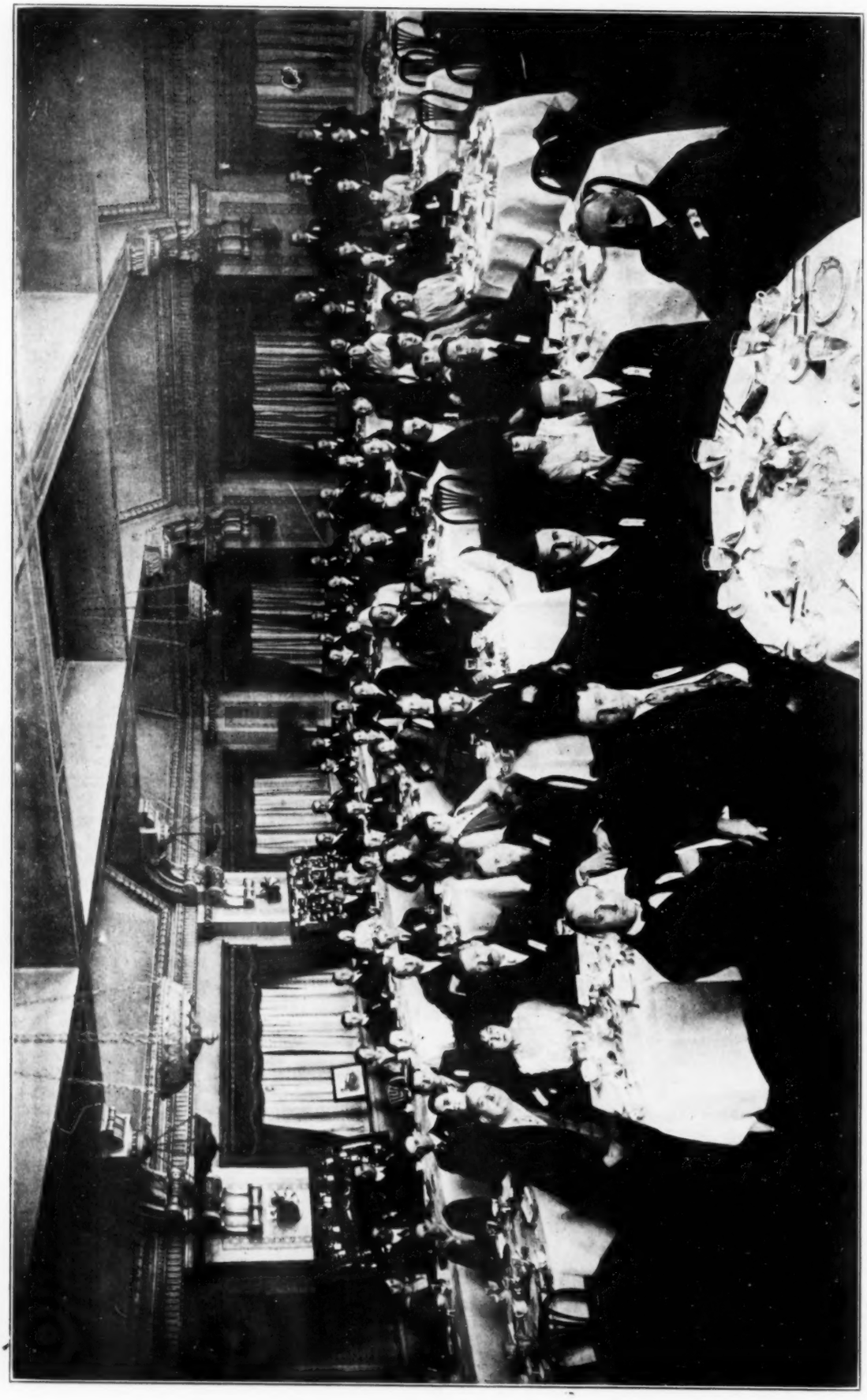
At the conclusion of the program the floor was cleared and dancing indulged in for the remainder of the evening. A picture of the banquet appears on the following page of this issue of THE METAL INDUSTRY.

AMERICAN ELECTROCHEMICAL SOCIETY

President, Lawrence Addicks; treasurer, Pedro G. Salome; secretary, Joseph W. Richards. All correspondence should be addressed to the secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa. The objects of the society are to promote the theory and practice of electro-chemistry and electro-metallurgy.

While the aniline dye, potash, and other chemical industries have attracted a great deal of attention since the beginning of the European war, little if anything has been heard about the great impetus the war has given our electrochemical industries. Many electrochemical products, such as chlorine and hydrogen, which were a drug on the market before the war, have become valuable. Now electrochemical industries, like that of metallic magnesium, have been started and the whole electrochemical development is of the utmost importance to the American nation.

The New York section of the American Electrochemical Society has therefore arranged a symposium on "Electrochemical War Supplies" which it will hold jointly with the New York section of the American Chemical Society and the Society of Chemical Industry at the Chemist Club, 52 East 41st street, New York, Friday evening, February 11. The program will include the following speakers: Lawrence Addicks, "Electrochemical War Supplies"; W. S. Landis, "Air Saltpeter"; E. D. Ardery, United States Navy, "Hydrogen for Military Purposes"; Albert H. Hooker, "New War Products"; William M. Grosvenor, "Magnesium"; G. Ornstein, "Liquid Chlorine"; Geo. W. Sargent, "Electric Steel."



THE THIRD ANNUAL BANQUET OF THE ST. LOUIS (MO.) BRANCH OF THE AMERICAN ELECTRO-PLATERS' SOCIETY, HELD JANUARY 22, 1916, AT THE AMERICAN HOTEL, ST. LOUIS, MO. A PLEASING FEATURE OF THIS BANQUET WHICH DISTINGUISHES IT FROM EVERY BANQUET WAS THE PRESENCE OF THE WOMEN.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST.

Royal F. Clark, who recently became connected as foreman plater with the Acme Shear Company, Bridgeport, Conn., reports that the concern is working night and day, eleven hours for each shift. They have also made extensive additions to their various buildings and in Mr. Clark's department have added six new nickel tanks so that now he is carrying 4,000 gallons of solution.

R. H. Evans, for many years associated with the Frictionless Metal Company, Chattanooga, Tenn., of this city, has resigned to accept a similar position with the Michigan Smelting and Refining Company, of Detroit, Mich., and with his family he will move to Detroit at once. The company with which he is now connected is one of the important industries of the country. Its products are copper, brass, tin, lead, spelter, solder, lead pipe, babbitt metals, special alloys, etc.

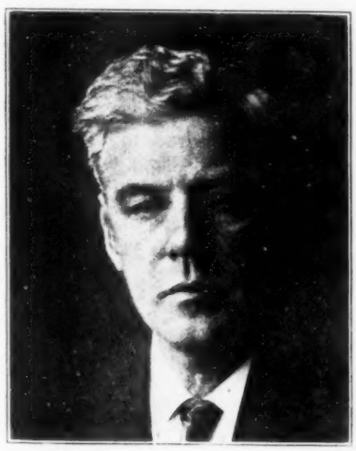
H. B. Klusmeier, founder of the Aluminum Manufacturing Company, 319 East Fourth street, Des Moines, Iowa, and secretary and general manager for nearly eight years, resigned at the annual meeting of the company and has accepted a position with the Aluminum Company of America, Pittsburgh, Pa. The officers of the Aluminum Manufacturing Company for the coming years are as follows: President, George O'Dea; vice-president, John A. Thomas; treasurer and acting secretary, J. E. Chambers. These men, together with Ellis Englebeck and Harry Leiferman, compose the board of directors. The company reports that the year 1915 was the best year in its history and they are planning to double the output of the plant in 1916.

W. J. Pettis, who was connected for the past twenty years with the Randolph-Clowes Company of Waterbury, Conn., and who is now assistant to the president of the National Brass and Copper Company, Lisbon, Ohio, is very much pleased with the results obtained by the use of natural gas in manufacturing copper—zinc alloys. The freedom from ashes resulting from the use of coal or coke and the consequent absence of any waste material to go through a washing system makes the casting shop look like "Spotless Town," and he is confident that it will be proved that the natural gas is in every way more economical than coal or coke.

DEATHS

JOHN A. HILL.

John A. Hill, president of the Hill Publishing Company of New York, died suddenly of heart disease on January 24, while on his way from his home to his office. Mr. Hill was the foremost technical journal publisher of the age and was fifty-seven years old at the time of his death.



JOHN A. HILL.

Mr. Hill was born on February 22, 1858, on a remote hill farm in the town of Sandgate, near Bennington, Vt. While a young lad his parents emigrated to central Wisconsin and he was educated in the public schools there. He early learned to shift for himself, and at 14 years of age went to work in a country printing office. He had a Yankee boy's liking for mechanics, however, and after some years in the printing office he became half owner of a machine shop, where he carried on repairs to a variety of local machinery.

His bent toward journalism and the printing office was shown by his founding in 1885 the Daily Press of Pueblo, Colo., which journal he edited for some time. As a writer he had a forceful and breezy style and his thorough familiarity with practical matters and with the ideas and needs of the men in the shops and on the road enabled him to write articles which were well received by the technical journals of that day.

A number of these articles were contributed to a modest sheet called Locomotive Engineering, which was published in New York by a company which also published the American Machinist. In 1888 Mr. Hill was invited to come to New York and take charge of Locomotive Engineering. Under his charge the journal rapidly increased in importance. Seeing the possibilities in the enterprise, Mr. Hill associated himself with Angus Sinclair, purchased the journal from its owners and undertook to carry it on as a separate publication. In this venture Mr. Hill was both editor and publisher, and his genius was well proved by the phenomenal success of the publication. Its subscription list grew by leaps and bounds, and rapidly assumed the leading position in its field.

It was evident to Mr. Hill's keen business sense, however, that a journal appealing largely to locomotive runners had not the elements for the largest financial success and he perceived the opportunity of applying modern business and editorial methods to the American Machinist, a journal of standing and reputation, which had been conducted for years along ultra conservative lines. In 1896 Mr. Hill sold his interest in Locomotive Engineering to his partner, Mr. Sinclair, purchased the American Machinist and laid the foundation for one of the largest enterprises in the field of technical publication ever established.

At that time practically all class publications had their printing done by contract and were limited by such facilities as the printers were willing to provide. Mr. Hill's early experience in the printing business had given him a strong liking for this side of the publishers' work, and he was ambitious that this publication should be able to own and operate its own printing plant.

It was this situation among others which led Mr. Hill to add to the successful American Machinist other well-established technical journals of high reputation. His first purchase was Power. Later the Engineering and Mining Journal passed under his control. In 1912 he purchased the Engineering News from its founder and chief owner, George H. Frost.

To carry on these various publications Mr. Hill organized the Hill Publishing Co., in which, while he held the largest interest, a number of those associated in the conduct of the various journals were also stockholders. A fifth journal, Coal Age, was established in 1911 to cover a field which it had become evident was too broad to be successfully reached by the Engineering and Mining Journal, chiefly devoted to metal mining interests.

An enterprise in which Mr. Hill took great pride and to which he devoted some of the best energy of the last years of his life was the construction on the west side of New York City of the great building to house his publications, which was completed in 1914. It was characteristic of Mr. Hill that the building was not only planned at every point to suit the convenience and economy of the printing and publishing business, but that unusual provision was made for the safety, comfort and health of the army of workers housed in the building.

Mr. Hill was vice-president of the Machinery Club, a member of the Engineers' Club of New York City and Railroad Club, Campfire Club and of the American Society of Mechanical Engineers, to which he was elected in 1913, among his references being Thomas A. Edison and James Hartness.

HERBERT D. COLE

Herbert D. Cole died very suddenly January 5, 1916, at his home in Springfield, Mass. He was New England representative for the Jonathan Bartley Crucible Company, of Trenton, N. J. Mr. Cole was born near Binghamton, N. Y., in 1863, and his entrance to the Crucible trade began with the beginning of that institution, September 1, 1908. For three years he occupied a position of trust, "behind the guns," inside the factory. The experience and education received at that time fitted him for the selling end far beyond the average, and the trade depended largely on his advice. He leaves a widow and son.

GEORGE APFEL

George Apfel, 60 years of age, and vice-president and treasurer of the Enterprise Brass & Plating Company, 2838 Spring Grove avenue, Cincinnati, Ohio, shot himself in his room at a Cincinnati hotel on December 29. He had been in poor health for the past two years, and this is supposed to have been responsible for the act.

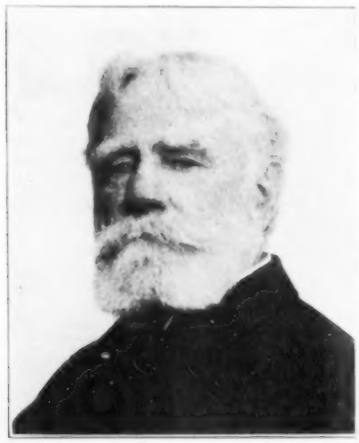
TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS.

BRIDGEPORT, CONN.

FEBRUARY 7, 1916.

Authentic information that the S. K. F. Ball Bearing Company, incorporated under the laws of the State of New York and with its main plant at Gothenberg, Sweden, is to locate in this city within a year was obtained here last week, causing the greatest flurry among manufacturers and business men since the announcement of the acquisition of the Remington Arms and Ammunition Company last year. It is reliably reported that the company has closed a deal for 25 acres of land in one of the outlying sections of the city, where it will enjoy immediate rail connection.



THOMAS WALLACE.
Mr. Wallace was the first man to draw copper wire in this country, and he founded the firm of Wallace & Company at Ansonia, Conn., in 1848. An account of his death, which occurred January 1, was given in the January issue of THE METAL INDUSTRY.

President Fred Enos of the Board of Trade did not care to expatiate upon the matter when interviewed, but he readily admitted that the Board day been endeavoring to induce the Swedish concern to come to Bridgeport for several months. The S. K. F. company is regarded as the most formidable competitor of the American Ball Bearing Company, employing thousands of men. Several real estate propositions are known to have been considered by the company's officials at its New York offices in Church street. Axel Carlander, a Swedish capitalist, is the president of the company, which is known in Sweden as the Atkiebolaget Soenska Kullagerfabriken. S. J. Hubbard is the vice-dent, and other officials are representatives of the big business type of American. The S. K. F. Company manufactures roller bearings for automobiles and gun carriages, and its object in locating in Bridgeport is believed to be to take advantage of facilities for direct communication and shipment to its sales offices in Chicago, as practically the entire automobile and munitions industries are located between Bridgeport and Chicago.

A few days ago President Enos of the Board of Trade announced that the Connecticut Alloyed Metals Company was to located in this city within a very short time, occupying the factory formerly used by the United Foundry and Machine Company, which is located in the east end, near the big plant of the Whiting Silver Company. W. P. Pearsons of New York, president of the company, announced that work was to begin at once on the erection of an additional building, in which the forging and smelting departments are to be located. One hundred furnaces are to be installed there. The main building of the plant is 185 by 100 feet, in one story. The company is capitalized at $500,000 and will manufacture alloys, such as bronze, brass, and German silver, in a capacity of 60 tons per day. James G. McKay of Stamford is vice-president and general manager of the company.

Another new concern which has located here recently is the Precision Gauge and Tool Company, at 135 Cannon street. It manufactures gauges and small tools, and the officers are G. O. Gabriel, president and treasurer; Rolland E. Norton, manager; and Harold DeW. Hotchkiss, secretary.

Recent developments in the city have shown that Bridgeport must pay the price for its rapid development in the last year. The tax rate has been increased radically, and the grand list will soar to unheard of figures, probably about $150,000,000. The city administration finds itself facing a need of expansion of sewers, schools, pavements and other public works that is unprecedented, and to that end the grand list has been extensively stretched. New buildings by the Arms company are valued by the building commissioners, in their issuance of permits, at approximately $3,500,000. The tax rate is to be 20.7 mills, so that the Arms company will add $70,000 to the city's revenue. The sum is far from adequate to meet the vast improvements which must be achieved before the locality in which the new "Remington City" has sprung up can be furnished with all the conveniences of the older part of the city. Mammoth additions to the Union Metallic Cartridge Company are still being carried on. On Helen street the company is rushing an eight-story building of eight connecting units, and a saw-tooth structure 200 feet long by 60 feet wide, which will constitute one of the largest additions to its growth.

An organization certificate combining the Remington Arms and Ammunition Company and the Union Metallic Cartridge Company was filed with the secretary of state at Hartford this week, showing that Marcellus Hartley Dodge of Passaic, N. J., owns all but 60 shares of the two companies, which, merged are to be known as the Remington Arms-Union Metallic Cartridge Company. Mercantile agencies are straining every effort to learn the whys and wherefores of the merger. Mr. Dodge, the president, owns all the 400,000 shares of preferred stock, and 599,940 shares of the 600,000 shares common stock. The remaining 60 shares are divided among Reginald Roome, Chauncey B. Garver, George Bingham, Henry Hoffman, Frederick W. Jackson, and C. L. Pierson, all of No. 55 Wall street. Samuel F. Prior of Greenwich, Conn., is elected vice-president, George Bingham, secretary and treasurer, C. W. Many of Brooklyn and William H. Nolan of Bridgeport, assistant treasurers.

Canditions in the metal trades in general continue at the high tide of prosperity which has been so marked in this city since last spring.—E. C. D.

HARTFORD, CONN.

FEBRUARY 7, 1916.

Freight congestion gave Hartford manufacturers much concern during the past month and served to turn attention from the congestion of orders which have kept the factories running overtime for the past several weeks. So difficult was it for the factories to get their shipments of raw material and oil, that

some of them seriously considered closing down; in fact, the Billings & Spencer Company was obliged to shut down for a half day January 15 on account of the lack of crude oil.

With the assistance of the Hartford Chamber of Commerce, the situation has become somewhat relieved, although the manufacturers are still uneasy, owing to the fact that the final settlement of the trouble cannot be assured by the New York, New Haven & Hartford Railroad Company officials for several days yet. At present, some of the Hartford companies are shipping heavy machinery by express, being unwilling to trust to the uncertainties of the freight accommodations. All of the sidings are crowded, and the Chamber of Commerce is trying to get consignees and consignors to co-operate in an endeavor to bring about relief.

It is said that it is the intention of the John Underwood Company of New York, which has a factory on Hawthorne street, Hartford, Conn., to bring its Brooklyn plant to this city and combine it with the local plant. It is probable that a new factory building will be erected in the spring, either south of the Royal Typewriter Company's property on New Park avenue or in Elmwood. The Brooklyn plant and the local factory both are at present operating at full capacity. The local end of the business, which is that of manufacturing adding machines, is being done on the fourth floor of the Chamber of Commerce building.

The S. K. F. Ball Bearing Company, of Gottenberg, Sweden, which recently capitalized a Hartford branch, has begun the erection of a $150,000 factory building on New Park avenue, large enough to accommodate 400 hands. A rumor that this company had suddenly decided to move to Bridgeport has been denied.

The Colt's Patent Fire Arms Manufacturing Company has started work on the construction of a new building just west of the present East Armory. Several bicycle sheds and other small buildings will be torn down to make way for the new building. Test borings have already been made. Plans made some time ago for a new building south of the West Armory have not been abandoned, but for the present, the new construction will be on the land described.

The building will have four stories, of mill construction, concrete with brick trimmings. It will be 175 feet long by 60 feet wide, which will give 42,000 additional square feet of floor space. The company will take from the East Armory the shipping, drafting and storage departments in order to provide much more additional space for manufacturing purposes. The building will be completed in four months.

At a meeting of the Colt Company held January 13, Samuel M. Stone, for some years sales manager of the company, was elected a vice-president, and Harold D. Fairweather was appointed assistant treasurer. Mr. Fairweather has been connected with the bookkeeping department of the concern for several years.

The Whitney Manufacturing Company has bought land and buildings on the south side of Elizabeth street for $12,000, and it is expected that it will build a new factory there in the near future.—T. C. W.

NEW BRITAIN, CONN.

FEBRUARY 7, 1916.

In New Britain proper, the initiatory month of the present year has seen but a few changes of importance in the metal manufacturing field; although one strike has been settled and the directors of several of the concerns have met and declared their quarterly dividends, in many cases gladdening the hearts of the stockholders by the granting of an extra dividend. Locally, however, there has been much doing of interest to the keen observer of metal manufacturing conditions. In Meriden the International Silver Company, crippled for several months by a big strike, struck back hard at the strikers by bringing suit for damages of $600,000 against the metal polishers', buffers', platers', brass and silver workers' unions and their affiliated locals in Meriden and Wallingford. In Plainville the recently organized Rockwell-Drake Company has begun the construction of a big factory building. Another Plainville concern, The Trumbull Electric Company, has planned to increase its capital stock from $500,000 to $600,000.

Looking first attentively at conditions in New Britain proper however, THE METAL INDUSTRY writer finds the wheels of industry buzzing as industriously as they have been for the past few months. Several of the factories are working overtime shifts and some have increased their previously reduced working schedule. In each concern business is good and in some it is booming. Recently the Russell & Erwin division of the American Hardware Corporation received a $200,000 order for materials for the municipal building at Pittsburgh. On top of this comes an agreeable $25,000 order to the P. & F. Corbin division of the same corporation to supply hardware for the new Park Terminal Building in New York.

At the North & Judd Manufacturing Company plant a strike among the molders has been settled, the entire foundry having been shut down for a month. No concessions were made to the strikers.

Financial statements at the various concerns in New Britain give possibly the best genuine view to existing conditions. The Union Manufacturing Company has granted a regular dividend of 2 per cent. and an extra dividend of 6 per cent. The annual statement of this concern shows an increase in the surplus of $144,824.89 during the past year. This concern has also adopted a plan finding favor with the big munition plants, that of paying a bonus to its employes. The directors of the New Britain Machine Company have also voted their regular dividend of 2½ per cent. and an extra dividend of the same amount. Summarized, the amounts paid in dividends are as follows: American Hardware Corp., $150,000; Landers, Frary & Clark, $80,000; Hart & Cooley, $10,000; New Britain Machine Company, $40,000; Union Manufacturing Company, $40,000; Stanley Rule & Level Company, $60,000; and Stanley Works, $62,500. Other concerns meet at different times, so cannot be included in this list.

Finding business conditions in New Britain to be good and smooth, a glance at Meriden is not amiss. The International Silver Company strike has not been settled and the suit brought by the company, as stated above, is on the grounds that the unions have unlawfully interfered with the employes in the company's factory, and with the men who wanted to work there.

Much interest throughout the east centers in Plainville. Here the new Rockwell-Drake Company is building a plant with 12,000 square feet of floor space. The products are to be machinery, gauges and ball bearings. Ball bearings are to be the principal product, however, and in this line the new company is to be a big competitor of the big New Departure Company of Bristol. In this connection it is of interest to note that Mr. Rockwell of the company is a son of A. F. Rockwell, who was recently deposed as president of the Bristol Company. The deposed president purchased the land on which the new factory is being built. His son is an experienced manufacturer and gained an expert's knowledge of the ball bearing business at the New Departure plant.

The increase of the Trumbull Electric Company stock from $500,000 to $600,000 will be voted at the annual meeting to be held on February 7. The $100,000 stock increase will be in preferred stock.

In New Britain, as elsewhere, the manufacturers are at present somewhat badly handicapped by the present freight embargo. Relief, however, is hoped for before conditions become serious. —H. R. J.

PROVIDENCE, R. I.

FEBRUARY 7, 1916.

In decided contrast to a year ago this time, the mills and factories throughout Rhode Island are rushed with business, there are plenty of orders on hand despite the possibilities that face many of the industries should the war come to an abrupt end. The metal working plants, such as the machine tool, machinery, foundry, and others of practically every description, are all working hard on orders that are called immense by many of those who are in a position to judge. There is a scarcity of men of all kinds and many of the manufacturers believe that this is going to prove a heavy handicap before many months.

The jewelry plants are not as busy as they were during the month or six weeks before Christmas, although they are showing more activity than they did a year ago. The present inertia, however, is normal and for that reason the manufacturers are not feeling very much concerned. In fact, most of them are of the opinion that there is considerable business right at hand and that, with the continued prosperity throughout the country, it will

not be very long before there is a great demand for jewelry workers of every class.

Seventy-five thousand dollars was the amount paid by an Attleboro firm during the first two weeks of the new year. Orders for stock to this amount were given a Waterbury, Conn., concern and the terms were cash upon delivery. This is probably the largest cash order for brass ever given in this section of the country, if not in America and eventually all of this metal will be turned into some form of jewelry. The purchasers produce gold and plate stock for manufacturing jewelers and are said to be looking for other opportunities, having the cash in hand with which to make purchases of such a character.

In the metal trades about 12,000 machinists and metal trade workers throughout Rhode Island have received increases in wages during the past few weeks, averaging 10 per cent. There is scarcely a metal working concern that has not given its employes at least a 10 per cent. raise within the last six months, and in many instances considerable more has been given. It is estimated that at the present time the metal trades are employing nearly 50 per cent. more men than usual.

The Providence Co-operative Sheet Metal Company, 338 Weybosset street, this city, has just completed a large copper marquise and a galvanized iron picture booth for the Bijou theatre at Southbridge, Mass. They have also made a large marquise for the building corner of Washington and Snow streets, this city; a heavy copper maquise for the Mohical Hotel at Fall River, Mass., and have recently completed the "Bolt Fast" hollow metal doors for the men's ward at the State Insane Asylum at Howard.

A one-story addition to No. 5 building at the plant of the Brown & Sharpe Manufacturing Company, is to be erected. It will be 64 by 75 feet, of brick and concrete. Joseph Jackovitz, doing business as Globe Sheet Metal Works, and formerly the Auto Sheet Metal Works, conducting a cornice and sheet metal business at 312 South Main street, has made an assignment to Edward H. Ziegler, for the benefit of his creditors. Articles of association have been filed at the office of the Secretary of State by the Woodland Machine Screw Company of Pawtucket. The concern is incorporated for $100,000 in shares of $100 each, common stock for the manufacture of screw machine products, metal novelties, rolled, drawn and tubular metals. The incorporators are Annie X. Doran, Annie C. Doran and Joseph G. Doran.

Joseph A. Holland, for nine years secretary of the Rhode Island Branch of the National Metal Trades Association, has resigned to take a position with the General Electric Company in Schenectady, N. Y., where he will be supervisor of employment, and in a sense, a mediator of shop troubles. He will sever his connections here on February 12 and take up his new duties two days later.—W. H. M.

BUFFALO, N. Y.

FEBRUARY 7, 1916.

A fairly brisk trade prevails in this market and there is much evidence that the Spring trade will be strong. All of the allied industries are becoming very busy so that it is natural that the non-ferrous will become more active. Prices of metals continues to be a constant worry to the local men because of their rapid fluctuations. This has resulted in a condition that little metal is bought except when it is absolutely necessary.

The foundries continue to have a good siege of business. Many believe that this will prove to be a remarkable year if business continues as it has during the past month.

Charles Knorr who for many years was the secretary and treasurer and general manager of the American Bronze Company has resigned. Mr. Knorr is not willing to state at this time, what he intends to do in the future.

The National Bronze Foundry is making a number of 1,000-pound bronze condensers for several of the local breweries. Lumen Bearing Company are doing a big business. They have booked enough orders to keep their plant busy for some months to come.

Within a month the Unique Brass Foundry will move into their newer and larger quarters at Grant and Military Road. Manager William Stewart says that they have enough orders to keep them busy until next summer.

The finishing and rolling mill end of the non-ferrous trade continues, as it has for months, to be very active. Every mill is busy to its capacity and there seems to be little doubt about their continuing to be throughout the greater part of the year.

The Buffalo Copper and Brass Rolling Mill are now running their new plant full swing. They are also making some additions to the newly completed buildings. This firm is the busiest place in Buffalo's non-ferrous metal trade. In fact they have never been so busy as they have been during the past year in their entire history of existence. Within the space of twelve months this firm has grown to be one of Buffalo's largest industrial establishments.

The Zero Valve and Brass Foundry are very busy making brass railing for a number of out-of-town jobs. These orders, alone, will keep them busy for over a month.

George Ray Manufacturing Company and the Aldrick Manufacturing Company both report that their trade has been very brisk during the past month.

The electroplating trade fell off a bit shortly after the first of the year, but this lull only lasted about two weeks when again they became busy. Business, these men say, has been picking up ever since and the prospects of spring trade is unusually good. It is expected that some of the local concerns will shortly make some additions to their plants because of the expected increase in their volume of business.

The Washington Plating Works during the past two weeks has been remodeling its offices. The A. F. Fries Plating Company has been unusually busy during the past two weeks.—G. W. G.

NIAGARA FALLS, N. Y.

FEBRUARY 7, 1916.

Trade conditions in this market are about the same as they were a month ago, with a slow but healthy gradual increase in the volume of business. In fact, the local men are opposed to the idea of a boom. They prefer the natural, normal growth of business because they believe it to be more lasting and more profitable. And it is generally believed that by next summer trade will reach its normal. Thus optimism is little disturbed by the fact that a presidential election is upon our threshold. They believe that the forthcoming election will have little or no effect on the present growth of business. Conditions cannot grow worse because the buyers have held off so long, their supply of materials are almost exhausted and therefore they must buy and the future trade is assured.

All local foundries are busily engaged in filling orders which will keep them busy for the next few months to come. And judging from present conditions a marked prosperous year lies within the reach of the Cataract City foundries.

The Titanium Alloy Manufacturing Company are getting out two new booklets. One is their 1916 edition of their "Standard Alloys." This new edition has been enlarged. It has a number of additional micro photographs, also a number of useful engineering tables which have heretofore never included in this booklet. The other booklet, which might be rightly called a book, is entitled "Ferro-Carbon Titanium in Steel." Throughout its one hundred and eight pages illustrations are shown on an elaborate scale. Tables, data and descriptive matter are in plenty. In a nutshell, this booklet is purely technical and deals entirely with the uses and advantages of titanium in steel. Either of these booklets may be had by the mere asking.

The electroplating, stamping and silver manufacturing trade is spotty. Some are more active than others, nevertheless a spirit of confidence prevails.

The Niagara Searchlight Company are working their plant to capacity getting out war orders.

A. Wright, the Niagara Falls Stamping Mill, the Spirella Company, etc., are having a good spell of business.—G. W. G.

COLUMBUS, OHIO

FEBRUARY 7, 1916.

The metal market in Columbus and central Ohio territory has been rather active during the past month. Demand has been on the increase and the volume of business is gradually growing larger. With the increase in the demand prices show a tendency to advance and every change is towards higher levels. The prospects for the future are good and preparations are being made for an active year.

One of the best features is the demand for aluminum, brass and copper. All these metals are rapidly advancing and the consumption is increasing. The manufacture of war munitions is one of the best reasons for the advance, although sales are not

confined to munitions concerns. All lines of manufacturing are expanding rapidly.

Copper is now selling around from 23 to 25 cents and no contracts for future delivery are being made at that price. Heavy brass scrap, red are quoted at from 16½ to 17½ cents and yellow brass scrap at from 16½ to 17 cents. Aluminum is higher, selling around from 43 to 44 cents. Babbitt is strong and the same is true of stereotype and linotype metals. Smelter is selling around from 19.05 to 19.30.

Work of erecting additions to the Solar Metal Products Company's plant in Cleveland Avenue is progressing. The company is working a double shift and has booked some exceptionally large orders.

In order to acquaint the trade with the men back of the concern, the Diamond Metal Stamping Company, 626 Kerr Street, has sent out a New Year's greeting, which contains the likeness and a brief business sketch of each officer and head of department. Clare Smith is president; Orrin Thacker, secretary and treasurer, and C. J. Parsons, general manager. President Smith said: "The past year has been strenuous for everyone, owing to the unprecedented rise in price of raw material, causing an upsetting of established prices. In the face of this fact, we are glad to report that our business has increased wonderfully. The outlook for the new year is especially bright."

The Acme Sheet Metal & Manufacturing Company of Cleveland, Ohio, has been incorporated with a capital of $10,000 to manufacture sheet metal. The incorporators are E. P. Schlosser, M. L. Harrington, W. C. Kelley, E. H. Rooke, and Joseph Hershey.

The Doylestown Aluminum Ware Company of Doylestown, Ohio, have increased their capital from $25,000 to $50,000.—J. W. L.

CINCINNATI, OHIO

FEBRUARY 7, 1916.

Activity at the local machine shops, and, therefore, at the foundries which supply them with the various metal castings used in the machinery trade, continues unabated, especially in view of the gradual collapse of the machinists' strike. Officially, the strike is still on, but, as a matter of fact, the various shops supposed to be affected are getting along perfectly well, without the slightest trouble as far as the labor end of the work is concerned. Demand continues at a high rate, and while the constantly rising prices of materials is not viewed with pleasure, exactly, it has had no depressing effect on the industry. When it is recalled that on a high-priced lathe of a popular model there is 125 pounds of brass and bronze, and that on even the smallest and cheapest lathe there is ten pounds of these materials, it can be understood what the activity of the machine-tool manufacturers for the past six or eight months has meant to local foundries; and reports indicate that this activity is going to continue for some time to come, regardless of the possibility of an early peace. The demand for machinery for domestic use is rapidly growing, with the return of prosperity in many lines and it is safe to say that for the most part the foundries and shops are getting into a position where they have to pick and choose between their orders, rather than go out and ask for business.

The Lunkenheimer Company, one of the largest valve and specialty manufacturers in Cincinnati, is planning to construct an iron foundry, with more than 50,000 square feet of floor space, as an addition to its plant in Fairmount during the spring.

The American Machine Tool Company will build this year an entirely new plant, to take care of its business, four stories in height and 200 feet square, to cost in the neighborhood of $400,000.

The Miami Brass Foundry Company, of Dayton, Ohio, is planning to put up a new building to take care of its business, which has grown rapidly during its ten years of existence, and which has necessitated rebuilding three times. The new plant will be two stories in height, of concrete and steel construction, with all modern facilities for handling the work. The company handles brass, bronze and aluminum work.—K. C. C.

DETROIT, MICH.

FEBRUARY 7, 1916.

The greatest announcement in the industrial field this month is a statement from Henry Ford that beginning within 30 days the Ford Motor Company will start operations to double its plant which at present has a payroll, according to Mr. Ford, of 24,000 persons. He further says $10,000,000 will be expended in this vast enterprise, and that when the new buildings are completed, which will be within five years, they will be employing close to 100,000, the greatest aggregation of employes controlled by one corporation known in the history of the world. This vast plant when completed, it is learned, will have one of the largest brass and aluminum foundries in the world, and in this department alone thousands of men will be engaged. At present great quantities of the Ford Motor Company's brass, gray iron and aluminum parts are manufactured by outside concerns. It now is Mr. Ford's plan, it is learned from reliable sources, to have all this production under the company's own direction.

Like the Ford institution, other automobile plants here are reporting great prosperity, one of these being the Packard Motor Car Company which is manufacturing both pleasure and commercial cars, and announces a pay-roll of $1,000,000 a month.

Frederick R. Stevens, manufacturer of foundry supplies, in a recent address before the Detroit Association of Credit Men, came out strongly against the promiscuous granting of credits, and said in his opinion no individual, firm or corporation with a rating under $5,000 should be entitled to a general credit favor. He declared that statistics have proved that this is the minimum safety point. His views met with general approval by the large number of credit men present, many of whom are employed by the biggest metal working concerns in the city.

The Signal Motor Truck Company here is in process of reorganization, and has under way an organization with a capital stock of $100,000. Chicago capitalists, it is said, have become interested in the enterprise, which has been struggling for a number of years to build up a strong organization, and apparently has succeeded. Its prospects for success were never brighter than at the present time.

Owing to the great demand for brass, copper and other material of this kind, organ manufacturers are finding difficulty in carrying out contracts. A large Detroit church, which ordered an unusually complicated instrument from a Boston, Mass., firm, has been informed that owing to inability to obtain brass and copper springs and other devices needed in its construction, the company would be unable to complete the instrument for a long time.

The local telephone company and the street car company here are also understood to have difficulty in obtaining copper wire, owing to the great demand on brass and copper manufacturing plants for war material.

The Detroit Valve Fittings Company has recently elected the following officers: President, E. B. Whitcomb; vice-president and general manager, O. P. Benjamin; treasurer, A. W. Fussey; secretary, Frank L. Uhl. The directors chosen are: E. B. Whitcomb, O. P. Benjamin, A. W. Fussey, E. D. Bronner and Bloss P. Corey.

The Detroit Brass Company recently elected the following officers: President and general manager, A. W. Fussey; vice-president, A. L. Hanson; treasurer, E. B. Whitcomb; secretary, G. C. Hall.—F. J. H.

There has been a steady improvement in the metal industries in this vicinity for the past month, and manufacturers are very hopeful for continued prosperity for the coming Spring with the amount of orders on their books.

The metal market in Detroit during the past month has developed considerably, and has verified the prediction made ten months ago that copper would reach 25 cents a pound before another year, as not since March, 1907, has copper been so high.

Domestic manufacturers, and especially those engaged in the making of munitions in which copper forms a component part, are all clamoring for the metal, and rivaling one another in their bids in some instances. Electrical devices, of which copper and brass are component parts, have advanced from 30 to 40 per cent. in price in the last few months in sympathy with the rising metal market. This advance reaches a tremendous sum when the amount of electrical supplies bought in Detroit every working day is considered.

Jobbers and contractors who bought before the present rise in prices are bound to save money, as there is no decline in sight.

An example of the way in which prices have alvanced is

shown in the increase on No. 14 copper wire. A comparatively short time ago this wire was sold to jobbers at $5.80, while now it costs $7.50.

Owing to the amount of business secured for automobile sheet metal parts and sheet metal stampings, the Clayton & Lambert Manufacturing Company finds it necessary to increase their equipment. This concern used to make a special line of plumbers' plow torches and furnaces as their main line of goods, and they have now installed in their new plant, corner of Trombley avenue and Beaubien street, additional presses, machinery and tools to take care of their increasing business. This company is now employing 500 men, and expects to increase the number to 1,000 as soon as everything is in running order

Requirements are so extensive in the plumbing and steam brass goods' lines, and stocks are so depleted that, except in isolated cases, there is no evidence that high prices are as yet curtailing purchases.

Many traveling salesmen are sending in larger orders than usual, and in some sections, notably in the Southwest, forward business is developing with exceptional rapidity. This not only indicates depleted stocks in plumbing and steam brass goods, also electric light fixtures, of which Detroit is a leading city for the manufacture of same. It is also convincing proof of general confidence in the future.

The Sherwood Brass Works, located on East Jefferson avenue, report a large demand for their products, and are running their plant to capacity.—P. W. B.

HOPEWELL, VA.

FEBRUARY 7, 1916.

It is reported that the E. I. du Pont de Nemours & Company has built in its powder plant here a small factory for the manufacture of aluminum, with a view of making it a permanent industry should the demand for guncotton decrease when the European war is over. The aluminum factory will soon be running, and will be conducted in the way of an experiment. If the project develops to be a success, the company will convert a portion of its plant into a factory for the manufacture of this metal.

It is known that the Du Pont Company has been testing out the machinery here, with a view of utilizing it for manufacturing different articles. It was intimated several months ago that, should there be a diminution of the demand for guncotton, the company would convert a part of its plant into a dye factory. It is said that the same machinery used in making munitions would be of use in manufacturing dyes, and since the outbreak of the war this country has been unable to secure dyestuffs, with the result that unusual steps are being taken by leading manufacturers to secure domestic dyes.

It is believed that at the conclusion of the war the Du Pont Company will use its powder plant here for the manufacture of several different articles and acids. The machinery in the plant is valued at more than $25,000,000.

While the fire of last December caused a numerous amount of damage to the business section of Hopewell, at the present time one would hardly believe that such a disaster had occurred. Everywhere building operations are in full sway and the new Hopewell promises to be far superior to the old. There are still thousands of tons of scrap iron and metal of various descriptions lying around on all sides and this offers a fine chance for dealers in scrap metals to make a good investment.—J. J. M.

LOUISVILLE, KY.

FEBRUARY 7, 1916.

According to the coppersmiths of Louisville, business has shown still further improvement during the month, and conditions are on a fairly firm basis at this time. Several nice jobs have been received and several more are in prospect on changing whisky plants in order that alcohol may be made in these distilleries. Copper prices are very stiff and are expected to go even higher. Sheet copper is quoted at about 31 to 32 cents from a base price, while fines are all quoted at 34 to 35 from base and ingot at 25 to 26. Less trouble is now being observed in obtaining copper than was the case thirty to sixty days ago, when it was almost impossible to get deliveries from the manufacturers of sheeting and tubing.

Elmore Sherman, head of the Vendome Copper & Brass Works, of Louisville, reports business has been so good with his company that arrangements have just been made to build a new addition to the plant. This addition will be 35 x 100 feet and will be used for handling sheet metal and tube work. The company has received a contract for changing the Glenmore Distillery, at Owensboro, Ky., from a whisky distillery to an alcohol plant. Three similar contracts are held at New Orleans, and the company is also installing a large fatty acid plant at Chicago.

According to some concerns there is such a demand for scrap copper that it is almost impossible to find supplies of good second hand copper and brass on this market, and most of the material being used at this time is purchased direct from the manufacturers.

The Kentucky Wagon Manufacturing Company has entered the market as one of the large consumers of finished brass in this district. A company known as the Dixie Motor Sales Company, has been incorporated by stockholders of the wagon company to market "Dixie" automobiles, which will be assembled by the wagon company. The concern manufactured machines in a limited way for the Hercules Motor Company last year. The company has also made arrangements to manufacture a light truck.

Louis Stege, secretary-treasurer of the Stege-Rindt Plating Company, a recent consolidation of the Rindt Manufacturing Company, and the E. A. Stege Manufacturing Company reports that the plating business is quiet as is generally the case in January. Since the consolidation of the two concerns casting has been done away with, with the exception of bronze tablets. All kinds of plating is handled with the exception of gold.

Business with the Independent Brass Works has been excellent since the early part of December. Metal is high and the concern is having trouble in obtaining second hand material on the local market. J. W. Rademaker, head of the Independent Company, reports that he has a lot of Government work on hand just now. This work consists in part of bronze railings, grills, etc., for Government buildings in various parts of the country.

About the only effect that the war has had on the copper industry in the Louisville district is that of bringing out a demand for alcohol, and numerous plants are considering a change in equipment so that they can manufacture grain alcohol.

The Ansonia Copper & Iron Works, of Cincinnati, O., which handles all of the distillery work for the Kentucky Distillers & Warehouse Company, has been very busy all through the fall remodeling whisky equipment into alcohol equipment. This machinery is being taken out of some of the plants and transferred, after remodeling, to the houses which are to manufacture alcohol. The copper concern has been short of men to handle the work, and has taken all of the available workers which could be spared in Louisville.

Hines & Ritchey, according to Tom Hines, have had an off year. Mr. Hines reports that the distillery work handled by his concern this year has been far below normal, and general work, with the exception of milk machinery, has been also below normal. Mr. Hines reports that there is undoubtedly an improvement in general conditions, however, and that he is looking forward to an excellent year in 1916. There has been a good deal of uncertainty in the field throughout the fall, especially among distillers who have been figuring on manufacturing alcohol in whisky plants. While the price of alcohol is very high, and the commodity is undoubtedly scarce, at the same time the price offered is hardly high enough to justify Kentucky manufacturers remodeling their plants to make it. Many distillers have been asking for prices on remodeling, and a few of these contracts may develop during the next sixty days.

An interesting comparison of the present prices of metals was recently shown by the Cumberland Telephone & Telegraph Company. This concern purchased a large quantity of new conduit cables, of lead and copper, shortly before the outbreak of the war, and at a time when such materials were low in price. The company is now installing these cables, and is disposing of the old cables at a price considerably above the entire cost of the new cables and the cost of installation. The old cables are being chopped up into short lengths and sold as scrap.

The Aluminum Company, of America, at Pittsburgh, Pa., is reported to making a number of additions to its plant at Maryville, Tenn. A fourth pot-room is now under construction, and two more are to be built.—G. D. C.

TRENTON, N. J.

FEBRUARY 7, 1916.

Business remains good along the lines of metal industry in this city and employes of the plans appear to be contented with the amount of work and wages paid. It was at first believed that metal workers in all the plants would take advantage of the prosperity wave due to the manufacture of war munitions and demand higher wages. This has happened only at a few of the factories. What the men asked for they received, the concerns fearing that there would be a tie-up and a delay in turning out the contract work.

A number of employes of the Jordan L. Mott Company have been notified that they have been granted a small increase in wages, the same taking effect during January. The increase only affects men who have been in the employ of the company for several years. Every year the company readjusts the wage list of the older employes and grants voluntarily an increase in salary. The Mott company is very busy at the present time and has more than doubled its working force during the past year because of the big order for war munitions.

The John A. Roebling's Sons Company will enlarge its plant by the raising of seven dwelling houses which the company recently purchased on Clark Street. The houses adjoin the site where the 700 foot long plant was destroyed by fire last November. The company will now enlarge that department. During the past few years the Roebling Company has purchased more than two score dwelling houses in different parts of the Chambersburg section to enlarge its plant. The Trenton Smelting and Refining Company have contracted with Bowman & Harris for the erection of a new office building on Pearl street. The old office structure will be utilized as part of the working plant. The annual report of the State Bureau of Industrial Statistics shows that seventy new factories were erected in New Jersey during the past year with a cost of $21,126,800 for buildings and machinery. Ninety plants were enlarged and the outlay for these improvements amounted to $5,158,770. In expenditures for new plants exclusively Trenton is first, with $360,000. This report does not include the new buildings started during December or January.

The factory of the defunct Electrolytic Art Metal Company at Beatty and Adeline streets has been sold to David W. Hutchinson for $15,000. It is said that another metal plant will be located there.

The Ingersoll-Trenton Watch Company has started a special day class in watch making at the Trenton School of Industrial Arts. The company is very busy at the present time and expects to be so in the years to come. Rather than import watch makers here it arranged with the city commissioners to have a day class in watch making at the Art School. The boys are taught by instructors from the watch plant.

Business remains normal at the McFarland Foundry and Machine Company, where brass and bronze castings are manufactured. The Billingham Brass and Machine Company during the month put on a number of bench molders. The company is very busy at this time and is buying up all the copper and brass it can get from the junk dealers in this section. The Mercer Automobile Company is very busy turning out machines for the dealers to handle in the early Spring. Considerable more metal is now used in the making of automobiles, metal taking the place of wood in some instances. When the company's new assembling building is completed many more men will be employed. The John A. Roebling's Sons Company is very busy at the present time, many of the employes putting in overtime in the copper cable shops. The Skillman Hardware Manufacturing Company finds business continuing good.

Daniel J. Bechtel, of the Bechtel Engraving Company, reports business picking up somewhat. "I believe we are going to have a good Spring and Summer," he said to a representative of THE METAL INDUSTRY. "A sure sign of returning prosperity is the fact that people are spending more money for articles in the metal lines that they could really get along without if money was scarce. Bronze and brass tablets are now bringing good prices and of course we have to demand more from customers. Our cast-off material is bringing better prices and this helps considerably." John W. Metz, president of the National Electric Plating Works, finds business improving and believes it will continue so.—C. A. L.

NEWARK, N. J.

FEBRUARY 7, 1916.

General business conditions during the first month of the new year were very encouraging. The volume of business continued to increase in a healthy manner. In some industries, which have to do principally with holiday goods, there has been a falling off, as is customary, but in some lines this drop has been less than is usually the case. The jewelry line, for example, was stagnant several months ago. In the early Fall the manufacturers began to receive more orders, and these continued to increase up to Christmas. With many jewelry manufacturers, October, November and December, 1915, showed far greater returns than the corresponding months in the previous year, and with a considerable number of concerns, than for several years. But the query on nearly everyone's lips was: "Will it last, or will things fall flat again after the first of the year?" They have not fallen flat, but have kept up remarkably well, considering the time of the year, inventories, etc., and jewelry manufacturers generally look for a good spring trade.

Electrical machinery concerns are very busy, and electroplaters, enamelers, chasers and etchers are doing well; some considerably better than a month ago. Within the past few months there has been a wonderful expansion of chemical plants in and about Newark. Many new factory buildings have been erected for the manufacture of chemicals, and others are about to be started. This remarkable increase in demands for chemicals is largely due to the war.

Platinum is daily becoming scarcer, and every possible source is being searched for scrap metal. Dentists who have been saving old pairs of false teeth containing platinum pins are sending these to the smelters. Manufacturing jewelers who have platinum jewelry in styles that do not sell readily, break it up and put it in forms that will sell, finding it more profitable at present prices to do this than to try to force the sale of the older jewelry. But in spite of such efforts platinum is daily becoming scarcer and dearer. Some manufacturers of platinum goods are temporarily dropping to a great extent the making of such goods. Substitutes are being used wherever possible.

The great demand throughout the country for brass and spelter for war purposes has interfered with legitimate manufactures of metal goods. Such manufacturers are constantly in a dilemma of either over-ordering materials at high prices, or ordering from day to day with the possibility of having to pay increased prices later, or perhaps not getting as much material as is needed. To over-order when prices are at their highest, and which might go down, would entail great losses. The majority of the manufacturers are, therefore, playing safe, ordering in comparatively small lots, and running the risk of having to pay a higher price for part of their materials. There has been a great increase in the prices of brass wire products of all kinds, including pins, hooks and eyes, etc., as well as novelties of many kinds, and it is quite likely they will soon be advanced again. But in spite of high prices there is a great demand for metal goods.

The address of the Interstate Smelting & Refining Company has been changed from 9-11 Railroad Place to 23-25 Commerce street. The firm is located at the same address as heretofore, but the city has renamed that section of the street where the company's plant is located. From December 1 to the present time the firm has been so busy that night work has been necessary. The outlook for the future is considered fine.

The Lafayette Manufacturing Company, Lafayette and Liberty streets, manufacturers of metal toilet goods, finds business very good. The outlook is reported very encouraging, except for the constantly increasing price of material, which makes it hard to know how to purchase materials to the best advantage.

The Newark Nickel Plating Company, 50 Walnut street, reports that business is better than it was, but that it is not satisfactory yet in that it is still on an uncertain basis.

On January 18 fire caused damage to the bay plant of the Balbach Smelting & Refining Company, in Doremus street, estimated at $10,000. An overheated furnace caused the blaze.

Jacob Fischee has been named as receiver for the Derigold & Metals Company, refiners, smelters and manufacturers of Cupror metal at 43-47 Oliver street. The claims of the petitioning creditors amount to $896. The creditors are Abram D. Jackson, Theodore E. Heyden and George S. Tuttle, all employes of the concern. The company was formed last summer, and purchased the plant of the bankrupt Renziehausen Company.—R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Martin Metal Company, Wichita, Kan., will build an addition to its factory, 110 x 140 feet.

The Chase Metal Works, Waterbury, Conn., has secured a permit for a one-story brick and steel addition.

Pass & Seymour, Inc., Solvay, N. Y., have let all contracts for a factory addition which they are to erect.

The Terry Steam Turbine Company, Hartford, Conn., announces the recent appointment of Maynard D. Church as chief engineer of their company.

Branchand Brothers, 13 Elm street, Rutland, Vt., are contemplating installing an electro-plating plant, and should like to hear from manufacturers of platers' supplies and lacquers.

The Globe Machine & Stamping Company, Cleveland, Ohio, is enlarging its plant by the addition of a second story, 100 x 165 feet. This concern operates a tool room, grinding room, stamping, brazing, plating, japanning and polishing departments.

Handy & Harman, gold and silver refiners, 59 Cedar street, New York, whose products are known throughout the country wherever gold and silver are used, call particular attention in this issue to their .999+ fine silver and gold anodes. Besides anodes they supply these metals in any shape or of any fineness.

The R. E. Dietz Company, lantern manufacturer, Greenwich and Laight streets, New York, N. Y., has purchased a five-story building, 25 x 101 feet, between Laight and Vestry streets. The site adjoins the buyer's present factory and will be converted into an addition to the factory.

The Northern Brass Company, Spencer, Mass., will have one of the largest and best equipped brass foundries in the country when the repairs to the factory have been completed. The company will manufacture brass and metal alloy products and in the near future expects to hire nearly a thousand men.

F. J. Klenck has opened an office at 225 Sharon Building, San Francisco, Cal., for the purpose of representing eastern metal manufacturers on the Pacific Coast. Mr. Klenck will also call on manufacturers of gas and electric fixtures, brass bedsteads, large plating plants and jobbers handling brass and copper in sheets, tubes, rods and wires.

The Premier Aluminum Foundry Company, Ivanhoe Road and Nickel Plate Railroad, East Cleveland, Ohio, has sent out cards to the trade announcing the opening of its new foundry which is said, by the company, to be one of the most modern and best equipped of its kind in Cleveland and that they are also prepared to fill orders for aluminum, brass, bronze and copper castings of all kinds.

The Zeh & Hahnemann Company, manufacturer of presses, automatic sheet-metal machinery, etc., Avenue A and Vanderpool street, Newark, N. J., has let contracts for the erection of a one-story brick addition, 42 x 50 feet, to provide more space for the manufacture of its patented percussion power presses, which they state are rapidly being introduced for producing hot pressed parts.

The St. Louis Brass Manufacturing Company, St. Louis, Mo., has begun the erection of an addition which will double its capacity. The new equipment will include apparatus for sherardizing. A brass, bronze and aluminum foundry, brass machine shop, tool and grinding rooms, spinning, galvanizing, brazing, stamping, soldering, plating, polishing and lacquering departments are operated by this company.

The American Metal Products Company, 3009 Lisbon aveune, Milwaukee, Wis., is at work at present equipping a larger plant which they will move into shortly and which will enable them to meet the demand for Ampco bronze, which they manufacture in the form of die-castings, sand castings and ingots. The new address of this company will be the Ampco Building, Milwaukee, Wis. Among the departments operated by this concern are as follows: Bronze foundry, brass machine shop, tool room, grinding room, cutting-up shop, stamping and polishing department.

The Niagara, Lockport & Ontario Power Company, Buffalo, N. Y., has begun stripping 150 miles of aluminum cables from its transmission lines in Western New York, which it has sold to the Fiat Automobile Company of Italy. The aluminum cable weighs approximately 558,000 pounds and the company will replace it with copper cable. By the deal it is said the company will realize $100,000 clear profit, selling the aluminum for 53 cents per pound and buying new copper cable at 21 cents. Officials of the company deny that the metal is being sold to the Allies for war purposes.

The controlling interest in the Sandusky Foundry & Machine Company, Sandusky, Ohio, has been sold by A. W. Henn of the National-Acme Manufacturing Company, Cleveland, J. R. Corrigan and William E. Guerin, Jr., also of Cleveland, to W. H. Millspaugh, formerly president of the company, and Russell A. Cowles, of New York. At the reorganization the three Cleveland men retired from the directorate and Mr. Cowles was elected president; Mr. Millspaugh, vice-president and sales manager; D. H. Ladd, Houghton, Mich., secretary, treasurer and general manager. Horace B. Fay, Cleveland, became a member of the board of directors.

W. E. Welborne, who has been here on a visit from Europe since October, 1914, with headquarters at the Hotel McAlpin, New York, announces that his purchases during that period have increased to such an extent as to warrant the establishing of a permanent business in this country. He has accordingly taken an office in the South Ferry Building, 44 Whitehall street, New York, where he will transact business as purchasing agent, import and export merchant and manufacturers' representative, under the name of Welborne & Co. Mr. Welborne also announces that during several years' travel in Europe he has made some very desirable connections in England, France, Belgium, Germany, Italy, and Russia, and is open to receive propositions from any progressive American manufacturer not already represented in these countries.

Reports are current to the effect that the Canadian Government is seriously considering arrangements for requiring refining in Canada of nickel. The operation of producing nickel from the crude ore is now performed in the United States, but it is reported that the Canadian Government may impose a heavy duty on exported nickel or may give a big bonus for its manufacture in Canada.

The Sudbury nickel industry is now in control of the International Nickel Company at whose refining plant in New Jersey most of the Canadian matte is treated. The export for last year totaled nearly $7,000,000, of which about $2,000,000 worth was diverted to Great Britain where the demand has increased owing to increased war consumption. The main reason given against any attempt before to compel the refining of nickel in Canada is that domestic market for nickel is limited and that it can be more economically refined in New Jersey and that the market in the United States is large and fairly constant and that a prohibition of export would cause serious industrial dislocation.

At the time of going to press no definite details are obtainable as to the results of the Canadian Government's deliberations.

CHANGE IN FIRM NAME

The C. C. & E. P. Townsend Company has sent out announcements that the name of that corporation has been changed, and that on and after January 1 it will be known as the Townsend Company, manufacturers of rivets, nails, wire and wire products, New Brighton, Pa. They also have sent out announcements that with the arrival of the year 1916 they have completed a century of business and that the company is the oldest wire mill in America. The officers of the new company are R. T. Townsend, president and general manager; J. M. Townsend, vice-president, and V. L. Bradford, secretary and treasurer.

REMOVAL

The Standard Brass Foundry Company, Cleveland, Ohio, has moved its plant from 1831 Columbus Road, to 988-992 East 67th street, where they are now completely established to manufacture high grade castings in aluminum, brass and bronze.

BUSINESS TROUBLES

The International Spray Company, 208 Center street, New York, N. Y., was thrown into bankruptcy January 13, on behalf of three creditors. Property of the concern, consisting of machinery, lathes, tools, patented devices for spraying paints, etc., gauges, office furniture and fixtures, etc., were sold at public auction on January 28.

Following the filing of an involuntary petition in bankruptcy in the United States District Court on December 24, against the Derigold and Metals Company, 43-47 Oliver street, Newark, N. J., Judge Haight appointed Jacob Fischel as receiver. The bankruptcy petition was filed by Abraham D. Jackson, Theodore E. Heyden and George S. Tuttle, each of whom claims money for wages, the aggregate amounting to $896. The company's plant, formerly the Renziehausen property, is now in the hands of the receiver, who is under $4,000 bond.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture and deal in metal products.—B. M. Gardner Company, Cleveland, Ohio. Capital, $10,000. Incorporators: James M. Sowers, K. C. Junke, B. M. Duncan, J. C. Quayle and F. H. Parker.

To manufacture and deal in all kinds of metals.—The Metal Stamping Company, Cincinnati, Ohio. Capital, $10,000. Incorporators: George F. Dittman, E. A. Dittman, Morris Froome, J. W. Gobing and Littleford Hunemeyer.

To deal in metals.—Continental Metals Company, Providence, R. I. Capital, $50,000. Incorporators: John S. Murdock, John A. Tillinghast and B. M. Pinney. The company operates

To manufacture aluminum products.—The Akron Aluminum Company, Akron, Ohio. Capital, $10,000. Incorporators: W. C. Washburn, George F. Andrews, H. W. Heckman and John Dildine.

To manufacture machines and metal novelties.—Edward J. Sibley Manufacturing Company, Bennington, Vt. Capital, $50,000. Incorporators: E. L. Sibley, D. A. Sibley, E. L. Sibley, Jr., and Tarrant Sibley. The corporation operates the following departments: Brass machine shop, tool room, grinding room, casting shop and stamping department.

To manufacture sheets, rolls, wire, bars, rods, tubes, etc.—American Brass Forging Company, Inc., New York, N. Y. Incorporators: G. W. Coughlan, president and treasurer and F. E. Hallfeld, vice-president and secretary. Brass and bronze foundry, brass machine shop, grinding room, plating, japanning, stamping, tinning, soldering, polishing and lacquering are the departments operated by this company.

FOREIGN TRADE OPPORTUNITIES

For addresses of these enquiries apply to Bureau of Foreign and Domestic Commerce, Washington, D. C., and give file numbers.

Brass tubing, No. 19866.—An American consular officer in Spain writes that a man in his district desires to represent American manufacturers of brass tubing, such as used for certain rods and lighting fixtures. It is stated that he will purchase at wholesale. Reference is given. Correspondence may be in English.

Aluminum bronze, etc., No. 19873.—A firm in Brazil informs an American consular officer that it is desirous of obtaining aluminum bronze and other materials used in making writing and other inks. Cash will be paid against documents in New York. Reference is given.

Bronze and aluminum powders, etc., No. 19978.—An American consular officer in Switzerland reports that printers and lithographers in that country are anxious to establish connections with American manufacturers and exporters of bronze, aluminum, imitation gold, and colored bronze powders, for printing labels and wrapping papers. A list of firms interested in purchasing these articles may be obtained from the Bureau or its district offices. Quotations should be made c. i. f. Marseille, Cette, or Havre for 100 kilos (220 pounds), in Swiss currency. Correspondence should be in German or French. Samples should be sent.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Crucibles.—Robert J. Taylor, Inc., manufacturer of crucibles, Philadelphia, Pa., is sending out a calendar pad to the trade.

Bronze—Ajax manganese bronze of various grades are thoroughly and adequately described in an interesting folder just issued by the Ajax Metal Company of Philadelphia, Pa.

Tools—James Clark, Jr., Electric Company, Louisville, Ky., has issued a small folder giving descriptions and illustrations of the Willey electrically driven tools which comprise center and tool post grinders.

Graphite Products.—The Bartley Graphite Products Company, Bartley, N. J., have issued circular matter relating to products which they are now manufacturing. These consist of Bartley's graphite motor and cup greases which are claimed to be superior to other graphite products.

Spraying Apparatus.—The De Vilbiss Manufacturing Company, Toledo, Ohio, have issued a new booklet "H" descriptive of the Aeron system and its accessory equipment. The booklet, which consists of twenty-four pages, gives a complete list of the company's Aeron air compressors and accessories. Copies of the booklet may be had upon request.

Rivets, Eyelets, Washers and Tubes.—Catalog No. 70 issued by the Edwin B. Stimpson Company, 70 Franklin avenue, Brooklyn, N. Y., relates to a variety of metal goods which are produced by this company. They include rivets of standard shape and size, and also a number of specials which are made to order. In addition to the different kinds of rivets, all of which are illustrated, the catalog shows nails, tacks, escutcheon pins, chains and hinges. The company also manufactures metal goods, both drawn and stamped in brass, copper, bronze, German silver, white metal and steel. Manufacturers who are in need of these particular specialties can obtain some interesting information by sending for Catalog 70.

Cork—The Armstrong Cork and Insulation Company, Pittsburgh, Pa., have issued a very comprehensive catalog of 52 pages giving description of their Nonpareil corkboard insulation, of which they make a specialty. The catalog is attractively gotten up, with an interesting history of cork and how it is gathered, and finally how it is manufactured into the Nonpareil corkboard. The catalog is bound in light gray boards and will make an interesting addition to any industrial library.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

COPPER.

NEW YORK, February 7, 1916.

It would be mighty interesting to know just exactly what the actual stock of merchantable copper was on the first of January. According to the government's final report there should have been anywhere from 150 to 200 million pounds of copper somewhere—unless, of course, the consumption was so far beyond any previous years. We are told it was and therefore the stocks of copper on January 1 were about the smallest on record.

Copper or no copper consumers have had to come up to the captain's office and pay the price starting at around 23¼ cents for electrolytic at the beginning of January. The price of copper has been forced up about 2½ cents per pound and the large producers, we are told, are pretty well sold up, as far ahead as May. It has become a source of real anxiety to some of the larger producers of copper as to what the poor consumers are going to do for any copper they may require during the next two or three months. It seems too bad the producers should be so worried as though they have not trouble enough of their own.

Well, the price, as we said before, has been pushed up about 2½ cents per pound and looks like going a good deal higher. The price at the end of January is around 25½ to 26 cents for Electrolytic, and 25½ cents for Lake. Casting is not so easily manipulated and is selling today at 24 to 24¼ cents. The exports for the month are about 24,000 tons, and the consumption—it is such an easy matter to remember, given the production—the consumption is the amount plus the exports; that is, always just a little more than the given production. See how simple it is once you know the production.

Later.—Since the above skit on the copper market was composed it is whispered around in the trade that possibly the apparent shortage of nearby copper is attributed to a desire on the part of the large producers to accumulate a stock of copper for the enormous demand that will have to be filled at the end of the war. Meanwhile, the price of copper is being boosted and the only possible weak point in the situation is the duration of the war. It sounds plausible and good business policy.

TIN.

The tin market has been fairly active during the month while prices fluctuated about 5 cents per pound between the high and the low. Opening at around 42 cents the market closed at 41¾ cents after touching 45 cents as the highest, and 40⅞ cents as the low point for the month.

LEAD.

The lead market has been governed, as usual, by the lead trust. Opening at 5.50 New York basis prices were advanced to 6.10 and closed at 6.10. For a time the independents were lower sellers than the trust, but at the close they were from 5 to 10 points above the trust price. This state of affairs generally calls for an advance on the part of the trust.

SPELTER.

The spelter market has been quite active, but it does not show the effect of the supposed enormous demand for copper and brass. Prices fluctuated about 2 cents per pound during the month and closed at about 1⅜ cents per pound above the opening but nearly ¾ cent per pound below the high point for the month.

ALUMINUM.

The aluminum market has been more or less dull during the month. There has been some good export business put through and the material was picked up quietly without disturbing values. The home maker is now close up on deliveries and there has been a steady supply of fairly cheap stock to take care of the demand. We are coming to an increased production and it is only the export demand that will tend to keep the market steady. No. 1 virgin is offered around 55 to 56 cents and 98 to 99 pure remelt is offered at from 53 to 55 cents, according to quantity and delivery.

ANTIMONY.

Prices have advanced about 2½ cents per pound. Opening at around 41 cents prices advanced to 43½ cents and closed at 43¼ cents.

SILVER.

Silver prices advanced about 2 cents per ounce and closed at about ½ cent below the highest, at 57⅛ cents. On January 3 the price was 55⅞ cents, New York.

PLATINUM.

Platinum has been very scarce and prices are entirely nominal. The closing market quotation is $88 to $100 per ounce, but the trouble is to find the metal.

QUICKSILVER.

The price of quicksilver has gone beyond all bounds. Short supplies due to freight embargo and delayed shipments, with a heavy demand for certain war contracts, has resulted in an abnormal advance in values. From around $155 a month ago prices rapidly advanced to $300 per flask and sales are reported at from $5 to $10 a flask above this price. At the close the market is a shade easier with rather freer offerings and the market closes at $275 to $300 per flask.

SHEET METALS.

Sheet copper shows an advance for the month of about 4 cents per pound, while copper wire is about 2 cents higher. High sheet brass is around 37 cents.

OLD METALS.

The old metal market is firmer for all scrap. The advance in copper and lead has stimulated the other metals and the market is active and strong.—J. J. A.

JANUARY MOVEMENTS IN METALS

	Highest.	Lowest.	Closing.
COPPER,			
Lake	25.75	23.00	25.75
Electrolytic	25.75	23.00	25.75
Casting	24.25	22.00	24.00
TIN	45.00	41.00	41.75
LEAD	6.20	5.50	6.15
SPELTER	19.50	17.25	18.80
ANTIMONY (Chinese and Jap)	43.50	41.00	43.50
SILVER	57⅝	55⅞	57⅛

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper. 1915—Average for year, 18.94. 1916—January, 24.75.

Brass Mill Spelter. 1915—Average for year, 17.50. 1916—January, 22.25.

Metal Prices, February 7, 1916

NEW METALS.	Price per lb. Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	26.00
Electrolytic, carload lots	26.00
Casting, carload lots	25.00
TIN—Duty Free.	
Straits of Malacca, carload lots	41.25
LEAD—Duty Pig(Bars and Old, 25%; pipe and sheets 20%. Pig lead, carload lots	6.10
SPELTER—Duty 15%.	
Brass Special	20.00
Prime Western, carload lots, nominal	19.00
ALUMNUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	66.00
100-lb. lots, f. o. b. factory	60.00
Ton lots, f. o. b. factory	56.00
ANTIMONY—Duty 10%.	
Cookson's cask lots, nominal	....
Hallett's cask lots, nominal	....
American	44.00
Chinese, Japanese	44.00
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot, Placquettes, Ingots, Blocks	45.00
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	6.00
BISMUTH—Duty free	nominal
CADMIUM—Duty free	nominal 1.90
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty, 10% per flask of 75 pounds	300.00
GOLD—Duty free	$20.67
PLATINUM—Duty free	$88.00 to 100.00
SILVER—Government assay—Duty free	.56¾

INGOT METALS.			Price per lb. Cents.	
Silicon Copper, 10%	according to quantity		33	to 35
Silicon Copper, 20%	"	"	40	to 42
Silicon Copper, 30% guaranteed	"	"	48	to 50
Phosphor Copper, guaranteed 15%	"	"	34	to 38
Phosphor Copper, guaranteed 10%	"	"	32	to 36
Manganese Copper, 30%, 2% Iron	"	"	33	to 37
Phosphor Tin, guaranteel 5%	"	"	59	to 62
Phosphor Tin, no guarantee	"	"	44	to 47
Brass Ingot, Yellow	"	"	15	to 18
Brass Ingot, Red	"	"	19	to 21
Bronze Ingot	"	"	20	to 23
Parsons' Manganese Bronze Ingots	"	"	29	to 30½
Manganese Bronze	"	"	28	to 31
Phosphor Bronze	"	"	18	to 19½
Casting Aluminum Alloys	"	"	45	to 50

PHOSPHORUS—Duty free.		
According to quantity	35	to 40

Dealers' Buying Prices. Cents per lb.	OLD METALS.	Dealers' Selling Prices. Cents per lb.
20.50 to 21.00	Heavy Cut Copper	22.50 to 23.00
20.00 to 20.50	Copper Wire	22.00 to 22.50
17.00 to 17.50	Light Copper	18.00 to 18.50
15.00 to 15.50	Heavy Mach. Comp.	16.50 to 17.00
13.00 to 13.50	Heavy Brass	14.00 to 14.50
10.00 to 10.50	Light Brass	11.50 to 12.00
13.00 to 13.50	No. 1 Yellow Brass Turnings	14.00 to 14.50
13.00 to 13.50	No. 1 Comp. Turnings	14.00 to 15.00
5.00 to	Heavy Lead	.... to 5.50
12.00 to 13.00	Zinc Scrap	12.00 to 13.00
20.00 to 25.00	Scrap Aluminum Turnings	35.00 to 40.00
30.00 to 35.00	Scrap Aluminum, cast alloyed	35.00 to 40.00
30.00 to 35.00	Scrap Aluminum, sheet (new)	45.00 to 50.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 24.00	Old Nickel	20.00 to 24.00
20.00 to 24.00	Old Nickel anodes	20.00 to 24.00

PRICES OF SHEET COPPER.

BASE PRICE, 33 Cents per Lb. Net.

Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
	SIZE OF SHEETS.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	—
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ..... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ..... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ..... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ..... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ..... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ..... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ..... 1c.

ZINC—Duty, sheet, 15%.

	Cents per lb.
Carload lots, standard sizes and gauges, at mill.....24 cent basis, less 8%	
Casks, jobbers' prices	24½
Open casks, jobbers' prices	25

Metal Prices, February 7, 1916

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect February 3, 1916.

To customers who buy over 5,000 lbs. per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.35	$0.36	$0.37
Wire	.35	.36	.37
Rod	.35	.37	.38
Brazed tubing	.40	—	.42
Open seam tubing	.40	—	.42
Angles and channels	.40	—	.42

To customers who buy 5,000 lbs. or less per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.37	$0.38	$0.39
Wire	.37	.38	.39
Rod	.37	.39	.40
Brazed tubing	.42	—	.44
Open seam tubing	.42	—	.44
Angles and channels	.42	—	.44

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

28½c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	32c.	per lb. base
100 lbs. to 300 lbs. in one order	32½c.	" " "
Less than 100 lbs. in one order	34c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5 6

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet	
	Brass.	Bronze.
⅜ inch		
½ inch		
⅝ inch		
¾ inch		
⅞ inch		
1 inch		
1⅛ inch		
1¼ inch		
1½ inch		
1¾ inch		
2 inch		

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	39c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	34c.	" "
Muntz or Yellow Metal Rectangular sheets other than Sheathing	37c.	" "
Muntz or Yellow Metal Rod	35½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 50c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 4c. over Pig Tin. 50 to 100 lbs. 5c. over, 25 to 50 lbs. 7c. over, less 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

Gauge.	Width. Inches.	1 ton.	50 to 2,000 lbs.	Less than 50 lbs.
20 and heavier	3-30			
	3-3-			
21 to 24 inclusive	30-48			
	48-60			
25 to 26	3-30			
	30-48			
27	3-30			
	30-48			
28	3-30			
	30-48			
29	3-30			
	30-48			
30	3-30			

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.																	
12.	.109.																	
14.	.083.																	
16.	.065.																	
18.	.049.																	
20.	.035.																	
21.	.032.																	
22.	.028.																	
24.	.022.																	

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	41c.	16%	45c.
8%	42½c.	18%	45½c.
10%	43c.	20%	48c.
12%	44c.	25%	57c.
15%	44½c.	30%	63c.

GERMAN SILVER WIRE.

Quality	Net per lb.	Quality.	Net per lb.
5%	44c.	15%	50¾c.
8%	46c.	16%	51¼c.
10%	47½c.	18%	53¼c.
12%	49¼c.	30%	68½c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.